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Infrastructure, environment, facilities

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Mr. James Saric
Remedial Project Manager
USEPA Region 5
77 West Jackson Boulevard (SR-6J)
Chicago, IL 60605-3507

SEDIMENTS

Subject:
SRI Phase 2 Sampling Plan for Portage Creek Sediment Investigation

Date:
November 10, 2008

Contact:
Michael J. Erickson

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Our ref:
B0064552.500

Dear Mr. Saric:

On July 15, 2008 representatives of the United States Environmental Protection Agency (USEPA), Michigan Department of Environmental Quality (MDEQ), National Oceanic and Atmospheric Administration (NOAA), and Kalamazoo River Study Group (KRSG) met in Chicago, IL to discuss, among other items, a proposed work plan for Phase 2 Sampling in Portage Creek that the KRSG submitted to USEPA on May 29, 2008. In that meeting, the Agency representatives requested additional information concerning the basis for the proposed sampling locations in Portage Creek—which is part of Area 1 of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Site)—and the process used to classify proposed sediment core sampling locations as fine or coarse. No specific adjustments to the plan itself in terms of the number and locations of samples were requested. A revised work plan was submitted to USEPA on August 21, 2008. MDEQ provided written comments on September 12, 2008 and USEPA provided a final version of comments in a letter dated October 15, 2008. These comments have been addressed in this revised work plan, which supersedes the August 21, 2008 version.

Work Plan Objective and Overview

The objective of the work described in this work plan is to collect samples to document the current polychlorinated biphenyl (PCB) levels in Portage Creek, which is identified as a main objective in the USEPA-approved *Supplemental Remedial Investigation/Feasibility Study Work Plan – Morrow Dam to Plainwell* (Area 1 SRI/FS Work Plan) (ARCADIS BBL 2007a). This information will be used to provide current information on PCB spatial distribution and mass inventories. As outlined in Section 3.4.1.3 of the Area 1 SRI/FS Work Plan (ARCADIS BBL 2007a), Phase 2 of the supplemental sampling of Portage Creek calls for sediment cores to be collected at up to 40 locations based on Phase 1 probing and visual reconnaissance results

(approximately 75 percent of these cores are to be fine-grained sediments and 25 percent coarse, although the basis for fine and coarse designations is not specified). *Sampling locations are to be approved by the USEPA. As described in this work* plan, the KRSG plans to collect a total of 44 sediment cores and analyze sediment samples for PCBs according to SRI/FS Area 1 Work Plan requirements. A total of 39 new locations are proposed, 29 in locations classified as fine sediments and 10 in locations classified as coarse sediments; and five additional cores will be collected from locations where the highest PCB concentrations were observed in the 1993 Remedial Investigation (RI) samples.

Background

Phase 1 of the Area 1 SRI/FS Work Plan included a mapping and reconnaissance *effort to assess the sediment distribution in Portage Creek from Alcott Street to the* confluence with the Kalamazoo River. Sediment probing was completed at 52 transects along the creek spaced at 200-foot intervals (Figure 1). The sediment *distribution among transect locations was assessed by continuous visual inspection* and probing, as necessary. Maps of the locations of fine-grained sediment deposits observed between probing transects are provided as Figures 2 through 6. Cross-section plots that show stream channel and sediment probe depths at each transaction location are provided in Attachment 1. Approximate dimensions and volumes of sediment associated with the deposits observed between probing transects are provided in Table 1.

Portage Creek can generally be divided into four distinct segments based on slope and bank types. The first segment (Figure 7) is channelized in a concrete raceway over much of its length between Alcott and Reed Street and has the greatest mean bed slope of the four segments (slope 0.6 percent), with shallow, coarse-grained sediment and shallow water depths. This is a relatively high flow energy segment of the creek with minimal sediment accumulation (less than 1.0 foot in most transects). The second segment is characterized by reduced gradients (slope 0.3 percent), mixed bank types, and typical cross-sections having one concrete bank and one natural vegetated or soil bank. Probed sediment thicknesses in this segment were greatest adjacent to natural (i.e. un-armored) banks, with average thickness of 0.71 feet.

The third segment of the Creek has the lowest slope of the four segments (0.07 percent), and the greatest mean sediment thickness (4.0 feet, see Figure 7). Both banks are generally well vegetated in this segment. The greatest probe depths occur

a short distance upstream of the East Vine Street and Gibson/Pitcher Street bridge crossings. Culvert sills and/or flow constrictions at the culverts may have promoted sediment accumulation, which thins moving upstream from these two locations. Notable decreases in sediment thickness are observed immediately adjacent to concrete headwalls and caged riprap at bridges. The fourth segment of the Creek has similar mean sediment thickness (3.0 feet) as the third segment. Near the confluence with the Kalamazoo River, creek bed elevations are such that flow velocity is influenced by water level fluctuations in the Kalamazoo River. The bed surface slope (0.1 percent) is slightly higher than in the third segment, and mean sediment thickness (3.0 feet) is slightly lower). Banks in this area are similar to those observed in the third segment.

Continuous visual inspection and probing along Portage Creek indicates that sediment deposits tend to be located near banks, with scattered deposits within the Creek channel. Deposits were found in the upper two segments of the Creek (typically associated with eddy areas behind flow obstructions, vegetation, or outfalls), along the banks in the third segment, and in the lower reach of the Creek near the confluence. Deposits typically consist of fine sand and silt, and gray materials were noted in deposits, particularly those nearer to the confluence with the Kalamazoo River. Gray material was also observed in a deposit found in the upstream area between PCT5 and PCT6 (Figure 1). The mean depth of deposits ranged from 0.75 to 5.0 feet with an estimated volume range from 30 cubic feet (ft^3) to 6750 ft^3 (this deposit formed an "island" near the confluence).

Sediment type classification of each probing and reconnaissance location was necessary for purposes of Phase 2 sampling plan design. Historically the fine/coarse designations have been used to separate the two strata so as to bias sampling toward the fine-grained sediments, as they are most likely to contain elevated PCB concentrations.

Sediment type at each Portage Creek probing location was classified as coarse or fine based on field observations recorded during probing activities. Since no sediment cores were collected during Phase 1, the classification was based on probing and field observation data, considering the following factors:

- Sediment descriptions from visual observation of surface sediments recorded in field notes.

- Evaluation of sediment texture based on ease of penetration and how smoothly the probing rod traveled through sediments and layers encountered. Sediment "softness" or "stiffness" thus served as a surrogate for fine or coarse-grained sediment in this regard.

- Total probe depth. From prior experience greater depths of probable sediment tend to be coincident with accumulation of relatively fine grained material.

- Observation of the texture of surrounding sediments and creek channel environment (e.g., depositional or erosive, steep or gentle). Water clarity was good at the time of probing allowing for good visual observation.

- Observation of localized creek channel morphology. From prior experience, localized channel features that reduce flow velocity in a portion of the Creek channel tend to be areas where finer grained material may be expected.

The fine or coarse designations are used to describe sediments that are in reality a continuum of different grain-size distributions, and are reliable for sediments that clearly fall into one category or another. The designation based on this approach for transitional sediments that fall between clearly coarse and clearly fine is less reliable when compared to a deterministic measurement such as grain size distributions. Once sediment core samples are collected and analyzed, additional information, including visual descriptions, grain size data, and total organic carbon (TOC) data, will be available to further characterize sediment. The sediment cores collected during Phase 2 will be reclassified based on visual inspection and description of the sediment during sample segmentation for analysis. This reclassification will be performed according to a protocol to be developed jointly by KRSG and USEPA based on discussion from the July 15, 2008 meeting in Chicago. The core classification following that protocol will be included in the Site database maintained by ARCADIS. The fine and coarse designations assigned as described above are useful for purposes of sampling plan design; however, the reclassification following the protocol to be developed will be used in preparing statistical summaries of PCB data.

Fine and coarse designations for purposes of this sampling plan design are shown for each probing transect on Figures 2 through 6.

Sampling Strategy

The sampling strategy follows the Area 1 SRI/FS Work Plan, whereby the selection of sampling locations is to be based on the Phase 1 results and include approximately 75 percent from fine-grained sediments, with the remaining 25 percent from coarse sediments. During the meeting held July 15th in Chicago, USEPA and MDEQ emphasized that the goal of including approximately 75 percent fine sediment locations should not be interpreted as a minimum number of fine sediment samples and that if insufficient fine sediment locations were identified, that a reasonable number of fine sediment locations should be targeted even if it results in somewhat less than 75 percent of the total number of sample locations. The proposed core sampling locations result in 74 percent from fine-grained sediments and 26 percent from coarse-grained sediments (Table 2). However, as noted above, upon reclassification of these locations following the protocol to be developed, these percentages may change.

Selected probing transect locations where sediments were described as fine-grained (12 locations total) are targeted as core sampling locations (brown symbol PCT-series on Figures 8 and 9) and are distributed along the length and width of Portage Creek to provide spatial coverage. An additional 17 cores are proposed for collection from sediment deposits located between transects that are described as fine sediment based on field observation (brown symbol SD-series on Figures 8 and 9, described in Table 1). Sediment deposits were targeted based upon the presence of gray materials noted during field reconnaissance and the relative size of the deposit, as reported in Table 1. A total of 10 cores are proposed for collection at locations where coarse sediments were observed (tan symbol PCT- and SD-series on Figures 8 and 9).

It is possible that cores initially thought to be representative of fine-grained sediments based on probing data may, upon visual inspection of the collected core, be classified as representative of coarse sediment. This could result in significantly fewer than 75 percent of samples being obtained from fine sediments as determined by the Unified Soil Classification System (USCS). Toward the goal of obtaining approximately 75 percent of the samples from fine sediments, per the Area 1 SRI/FS Work Plan, additional cores may be needed to replace cores planned to be representative of fine sediments, but which are visually classified as representative of coarse sediments. Classification of sediment cores by visual inspection will be performed jointly with USEPA and MDEQ designated oversight personnel and may involve sectioning of certain lexane core samples to more directly observe sediment

texture. Once all planned sediment core samples have been obtained and visually classified, those cores for which a replacement sample is required to achieve approximately 75 percent fine samples will be identified and agreed upon with USEPA and MDEQ. For those samples, ARCADIS will work jointly with USEPA and MDEQ oversight personnel to identify locations for each replacement core in the general vicinity of the original planned location such that the overall along-Creek coverage of the sampling remains generally consistent with the planned locations. Replacement samples that were targeted to potential depositional areas based on probing (i.e. the biased locations) will be located generally between the same two probing transects that bounded the original planned location. Replacement samples from transects will be obtained from along the same transect, or the upstream or downstream transect so as not to compromise the unbiased aspect of the sample location design. The locations for the replacement core samples will be determined by field reconnaissance and the rationale for each location documented in the field logs. If definitively fine sediments are not present in the area for each replacement core sample, the sample will either be targeted toward sediment that is relatively the finest in that area, or the replacement sample will not be collected. All replacement cores will be obtained during the same field sampling mobilization as for the originally planned core sampling locations.

Per the Area 1 SRI/FS Work Plan, five cores will be collected from locations exhibiting the highest sediment PCB concentrations in 1993 RI samples (locations are PPT1-1, PPT1-4, PPT8-3, PPT9-1, and PPT10-2), which are shown on Figures 8 and 9 with green square symbols.

Core locations PCT47-1 and PCT49-2, in the northern section of the creek where probing data indicated a relatively higher proportion of fine sediments, are proposed for Total Compound List/Total Analyte List (TCL/TAL) and simultaneously extracted metals/acid volatile sulfide (SEM/AVS) analysis. PCT47-1 and PCT49-2 were described as "Fine sand and silt" and "Light gray fine sand and silt", respectively, during field reconnaissance. Examination of the descriptions of all probing locations classified as fine-grained sediments suggests that the PCT47-1 and PCT49-2 locations are likely representative of fine-grained sediments in the creek corridor, and are therefore targeted for TCL/TAL and SEM/AVS analysis. Once the sediment cores are collected, if it is obvious that these cores are not representative of the fine grained sediments in the Creek, one or two alternative core locations will be identified jointly with USEPA oversight personnel through visual inspection of the core samples.

A listing of the proposed core sample locations is provided in Table 3 along with sediment type, and position along the length and width of the Creek.

All sediment cores will be collected at the proposed locations and sectioned and processed for analysis in accordance with the methods and protocols in the USEPA-approved Area 1 SRI/FS Work Plan and the *Multi-Area Field Sampling Plan* (ARCADIS BBL 2007b).

Sampling Schedule

Contingent on USEPA approval of this plan, and availability of USEPA oversight, ARCADIS intends to initiate Phase 2 activities in Portage Creek on December 1, 2008. It is anticipated that field sampling and processing of samples for shipment to the laboratory will take approximately 8 working days. If this date is unworkable, ARCADIS will select a revised schedule jointly with USEPA. ARCADIS will provide a detailed schedule of planned sampling activities to USEPA immediately following approval of this work plan.

Sincerely,

ARCADIS

Michael J. Erickson, P.E.
Associate Vice President

Copies:
Paul Bucholtz, MDEQ
Jeff Keiser, CH2M HILL
Todd Goeks, NOAA
David Guier, Millennium Holdings, LLC
Suda Arakere, Millennium Holdings, LLC
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Enclosures:

Tables

Table 1 – Sediment Deposit Descriptions – Portage Creek

Table 2 – Proposed New Core Sampling Locations – Summary by Creek Segment and Sediment Type

Table 3 – Proposed Core Sampling Locations

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Figure 1 – Sediment Probing Locations – Portage Creek Alcott St. to Confluence

Figure 2 – Sediment Transect Sampling Characterization – Portage Creek Transects PCT1 to PCT8

Figure 3 – Sediment Transect Sampling Characterization – Portage Creek Transects PCT9 to PCT20

Figure 4 – Sediment Transect Sampling Characterization – Portage Creek Transects PCT21 to PCT30

Figure 5 – Sediment Transect Sampling Characterization – Portage Creek Transects PCT31 to PCT40

Figure 6 – Sediment Transect Sampling Characterization – Portage Creek Transects PCT41 to PCT53

Figure 7 – Portage Creek Longitudinal Profile

Figure 8 – Proposed Sediment Sample Locations – Alcott Street to Crosstown Parkway

Figure 9 – Proposed Sediment Sample Locations – Crosstown Parkway to Kalamazoo River

Attachment 1

Portage Creek Transect Cross-Sections

References

ARCADIS BBL. 2007a. *Supplemental Remedial Investigation/ Feasibility Study Work Plan – Morrow Dam to Plainwell.* February 2007.

ARCADIS BBL. 2007b. *Multi-Area Field Sampling Plan.* October 2007.

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Tables

Kalamazoo River Study Group
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
SRI Phase 2 Sampling Plan for Portage Creek Sediment Investigation

Table 1 – Sediment Deposit Descriptions -- Portage Creek

Sediment Deposit ID	Stream Location (bounding transects)		Channel Location	Length (ft)	Width (ft)	Average Depth (ft)	Volume (ft^3)	Geomorphic Feature	Material Description	Notes
1	4	5	East bank	12	4	1	48		Fine sand, little silt, trace oil sheen.	75' down from T-4; channel deposit throughout fine sand to coarse sand; between fine gravel to coarse gravel.
2	4	5	East bank	25	3	0.75	56.25		Fine sand to medium sand, little silt, trace sheen.	33' up from T-5.
3	5	6	East bank	10	4	0.75	30		Fine silt, silts between rock and brick.	Sewage odor, 10' feet down left bank at T-5.
4	5	6	East bank	65	4.5	3.5	1023.75		Exposed sediment, grey waste material.	Localized grey waste in water at 85' and in exposed sediment, low terrace within raceway (vegetated), starts 35' down west bank.
5	6	7	In channel	6	6	1	36	Aggrading bar	Fine to medium sand with coarse sand, fine gravel, vegetation.	22' off east bank.
6	6	7	East bank	15	2	1.2	36		Exposed sediment.	
7	6	7	East bank	40	4	2	320		Exposed sediment.	Extension of S-4.
8	6	7	East bank	25	12	1.2	360	Deposit	Fine to coarse sand, gravel, brick, rock, concrete.	Between center pier and left wall, under old industry bridge #1.
9	6	7	West bank	22	8	2	352	Deposit	Fine to coarse sand, fine to coarse gravel, rock, brick, debris.	Just after old industrial bridge #1.
10	7	8	East bank	60	7	0.75	315	Low terrace	Fine to medium sand over fine to coarse sand, fine and coarse gravel.	Grading to channel deposit, starts 15' downstream from T-7.
11	9	10	East bank	30	4	2.5	300		Fine to medium sand.	Ends 12' up from T-10.
12	10	11	West bank	25	8	1.2	240		Fine to medium sand, some fine gravel, little silt.	Ends +/- 30' upstream of T-11.
13	11	12	West bank	45	9	2	810		Fine sand over gravel, little silt.	Starts at T-12, goes upstream 45'.
14	12	13	East bank	15	8	1	120		V.L.S. (???) Fine silt.	Eddy area 60' upstream of T-13.
15	12	13	West bank	15	7	1.5	157.5		Fine sand and silt.	30' upstream of T-13.
16a	13	14		15	10	1.5	225		Organic silt over fine sand.	Behind downfall.
16b	14	15	East bank	25	5	1.5	187.5		Fine sand.	Starts at T-14 behind vegetation.
17	14	15	East bank	100	5	1.5	750		Fine sand.	100' downstream of T-14.
18	16	17	East bank	20	5	3	300		Fine sand and silt with organic mixed in.	80' upstream of T-17.
19	17	18		25	7	2.5	437.5		Fine sand.	+/- 100 downstream of T-17.
20	19	20				3.5	0		Very loose/soft silt and detritus over fine sands/silt. Sheens prevalent while probing.	50-150' downstream of T-19, good location for sediment core.
21	24	25					0		Very loose soft fine sand, silt.	100-150' downstream of T-24, EOW to EOW.

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SRI Phase 2 Sampling Plan for Portage Creek Sediment Investigation

Table 1 – Sediment Deposit Descriptions -- Portage Creek

Sediment Deposit ID	Stream Location (bounding transects)		Channel Location	Length (ft)	Width (ft)	Average Depth (ft)	Volume (ft^3)	Geomorphic Feature	Material Description	Notes
22	25	26		25	10	5	1250		Fine sand, silt, sediment builded up, organic (leaves trees).	5' probed upstream of crosstown parkway bridge.
23	26	27	East bank				0		Grey blue sediment.	Beginning at Crosstown Parkway bridge downstream to T-27, 5-10' out of EOW.
24	31	32	West bank				0		Grey sediment with odor.	Appears to be localized.
25	39	40		6	6	4.5	162	Deposit	Primarily fine sands/silt, petroleum type odor.	Sediment deposit at 30" concrete pipe outfall.
26	41	42	East bank	5	10	2.5	125		Fine sands/silts.	In washed-out bank area; 50' upstream of T-42.
27	41	42	East bank	10	10	2.5	250		Fine sands/silts.	In washed-out bank area; 20' upstream of T-42.
28	47	48	West bank	25	7.5	2.5	468.75	Deposit	Fine sand/silt depositional area.	Starting at T-47.
29	48	49	West bank	75	10	2	1500		Light gray claylike material exposed in some places.	100-175' downstream of T-48 adjacent to driven sheetpile wall.
30	49	50	East bank		7.5	3.5	0		Gray claylike material exposed intermittently along creek banks, predominantly "b" side.	
31	50	51	East bank				0		Exposed gray claylike material on both sides of creek in bank, predominantly along "b" side.	Sometimes gray material is exposed as high as 4' above current water level.
32	51	52	West bank				0		Gray claylike material along banks (predominantly "a" side).	Starts immediately downstream of Michigan Ave. bridge to T-52.
33	52	53	In channel	60	25	4.5	6750		"Island".	
34	52	53	East and West bank				0		Gray claylike material along both banks intermittently.	Between T-52 and T-53.
35			West bank				0		Gray claylike material exposed intermittently along T-53 to 25-30' at sediment surface.	

Notes:
ft - feet

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SRI Phase 2 Sampling Plan for Portage Creek Sediment Investigation

Table 2 - Proposed New Core Sampling Locations Summary by Creek Segment and Sediment Type

Creek Mile[1]	Description	Transects	# Fine	# Coarse
0 - 0.54	Confluence to Pitcher Street	PCT39 - PCT52	13	5
0.54 - 1.03	Pitcher Street to Crosstown Parkway	PCT26 - PCT38	2	2
1.03 - 1.67	Crosstown Parkway to Reed Street	PCT9 - PCT25	12	2
1.67 - 1.94	Reed Street to Alcott Street	PCT1 - PCT8	2	1
		Total	29	10
			74%	26%

Notes:

1. Distance from confluence of Portage Creek and Kalamazoo River measurements approximated using street centerlines downloaded from the Michigan Center for Geographic Information.
2. Table does not include resample locations.

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Supplemental Remedial Investigations/Feasibility Studies
SRI Phase 2 Sampling Plan for Portage Creek Sediment Investigation

Table 3 - Proposed Core Sampling Locations

Creek Segment	Location ID	Sediment Classification	Sample Position	
			Creek Mile	Approximate Distance from West Bank (ft)
Confluence to Pitcher Street	PCT53-9	Coarse	0.0028	80
	SD #35	Fine	0.0147	n/a
	SD #34	Fine	0.0185	n/a
	PPT1-1	Fine	0.032198	10
	PPT1-4	Fine	0.032198	47
	SD #32	Fine	0.0682	n/a
	PCT51-1	Fine	0.071	0
	SD #31	Fine	0.09	On East Bank
	PCT50-6	Coarse	0.1089	25
	PCT49-2[3]	Fine	0.1468	5
	SD #29	Fine	0.1648	n/a
	PCT48-4	Coarse	0.1837	15
	SD #28	Fine	0.2197	n/a
	PCT47-1[3]	Fine	0.2197	0
	PCT46-1	Coarse	0.2623	0
	PCT45-1	Fine	0.3002	0
	PCT44-1	Fine	0.3381	0
	PCT42-3	Coarse	0.4119	10
	SD #27	Fine	0.4157	n/a
	SD #25	Fine	0.5048	n/a
Pitcher Street to Crosstown Parkway	PCT36-4	Coarse	0.6354	15
	PCT33-1	Fine	0.7453	0
	PCT31-2	Coarse	0.8239	5
	PPT8-3	Fine	0.908173	26
	PCT26-9	Fine	1.0152	36.9

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Supplemental Remedial Investigations/Feasibility Studies
SRI Phase 2 Sampling Plan for Portage Creek Sediment Investigation

Table 3 - Proposed Core Sampling Locations

Creek Segment	Location ID	Sediment Classification	Sample Position	
			Creek Mile	Approximate Distance from West Bank (ft)
Crosstown Parkway to Reed Street	SD #22	Fine	1.0389	n/a
	PCT25-1	Fine	1.0464	0
	SD #21	Fine	1.0653	n/a
	PCT24-1	Fine	1.0843	0
	PPT9-1	Fine	1.124089	17
	PCT22-1	Fine	1.1601	0
	PPT10-2	Coarse	1.246252	20
	SD #20	Fine	1.2623	n/a
	PCT19-7	Fine	1.2718	30
	PCT17-3	Coarse	1.3457	10
	SD #18	Fine	1.3608	On East Bank
	PCT16-2	Fine	1.3836	5
	SD #16a	Fine	1.4759	n/a
	SD #15	Fine	1.4896	n/a
	SD #14	Fine	1.5137	On East Bank
	PCT9-6	Coarse	1.6478	23.5
Reed Street to Alcott Street	SD #04	Fine	1.7766	n/a
	SD #03	Fine	1.7936	On East Bank
	PCT3-3	Coarse	1.8552	10

Notes:

1. Distance from west bank varies along the length of sediment deposits, and is therefore not reported here.
2. n/a - not applicable; distance from west bank not measured for sediment deposits.
3. Core proposed for TCL/TAL and SEM/AVS analysis

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Figures

SYR-90 MTK
KRSG (64553.0500)
Q:\KRSG\MorrowDamToPlainwellDam\SRI_Phase2SamplingPlan_PC\mxd\Sediment Probing Locations - PC_v2.mxd - 11/6/2008 @ 3:17:32 PM

LEGEND:

- SEDIMENT PROBING TRANSECT COMPLETED SEPTEMBER 2007
- PORTAGE CREEK CENTERLINE (APPROXIMATE)

0 700 1,400 Feet
GRAPHIC SCALE

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AIR LAND SURVEYS, INC., KALAMAZOO RIVER FLOWN 4/24/99, PORTAGE CREEK FLOWN 4/27/00.
2. SEDIMENT TRANSECT PCT2 WAS NOT PROBED DUE TO ACCESS ISSUES.

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

SEDIMENT PROBING LOCATIONS - PORTAGE CREEK ALCOTT ST. TO CONFLUENCE

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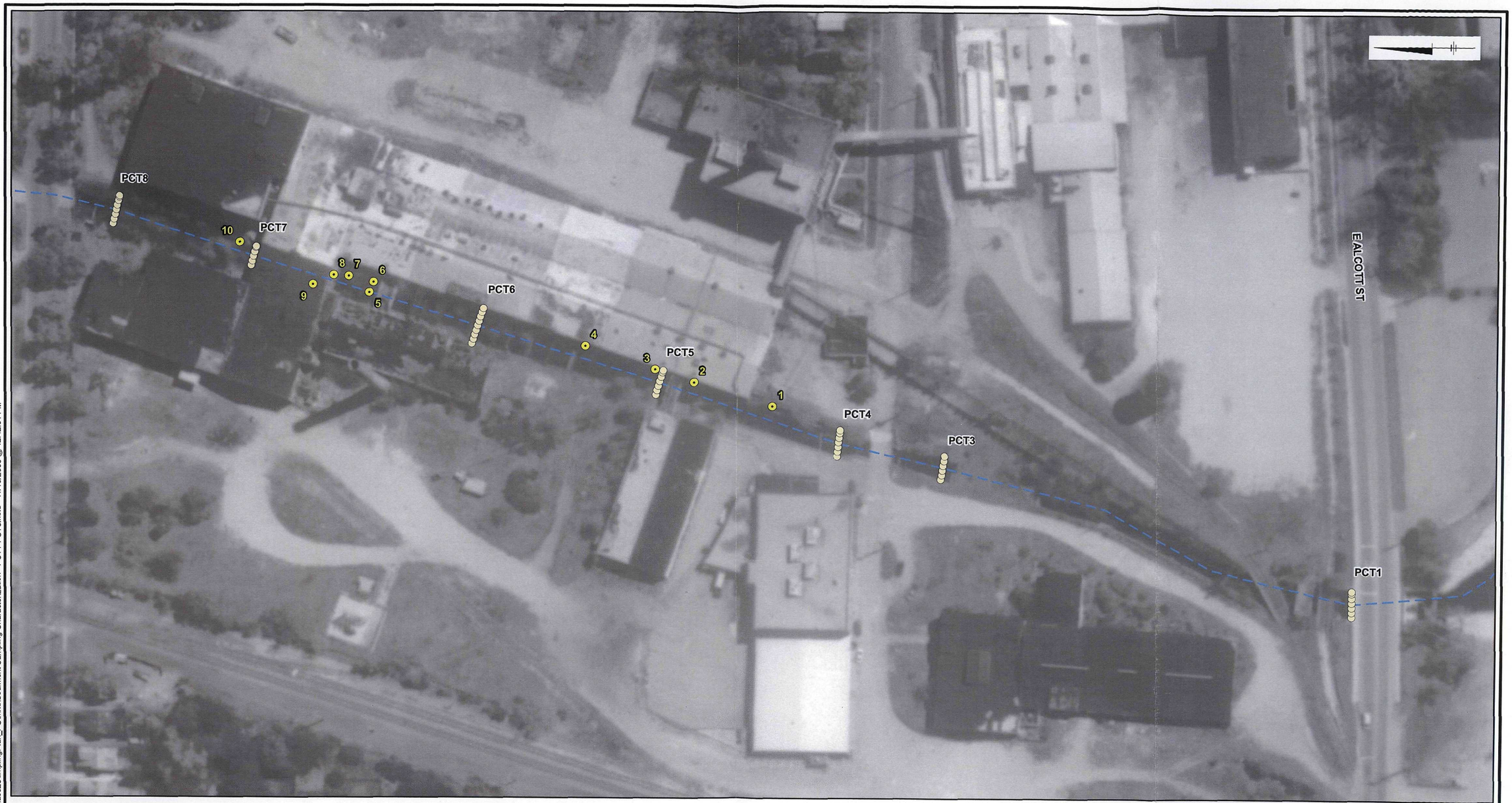
FIGURE 1



LEGEND:

- SEDIMENT DEPOSIT LOCATION (APPROXIMATE)

SEDIMENT PROBING LOCATION

MATERIAL CLASSIFICATION:

- FINE
- COARSE
- PORTAGE CREEK CENTERLINE

0 100 200 Feet

GRAPHIC SCALE

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AIR LAND SURVEYS, INC., KALAMAZOO RIVER FLOWN 4/24/99, PORTAGE CREEK FLOWN 4/27/00.
2. SEDIMENT DEPOSIT LOCATIONS DESCRIBED IN TABLE 1.
3. SEDIMENT TRANSECT PCT2 WAS NOT PROBED DUE TO ACCESS ISSUES.

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

SEDIMENT TRANSECT SAMPLING CHARACTERIZATION - PORTAGE CREEK TRANSECTS PCT1 TO PCT8

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FIGURE 2

SYR-85 MTK KEW
KRSG (B0064524.0000.0500)
Q:\KRSG\MorrowDamToPlainwellDam\SRI_Phase2SamplingPlan_PC\mxd\Sediment Sampling Characterization - PCT1-PCT8.mxd - 11/10/2008 @ 12:42:51 PM

LEGEND:

- SEDIMENT DEPOSIT LOCATION (APPROXIMATE)

SEDIMENT PROBING LOCATION

MATERIAL CLASSIFICATION:

- FINE
- COARSE
- PORTAGE CREEK CENTERLINE

0 150 300 Feet

GRAPHIC SCALE

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AIR LAND SURVEYS, INC., KALAMAZOO RIVER FLOWN 4/24/99, PORTAGE CREEK FLOWN 4/27/00.
2. SEDIMENT DEPOSIT LOCATIONS DESCRIBED IN TABLE 1.

KALAMAZOO RIVER STUDY GROUP
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KALAMAZOO RIVER SUPERFUND SITE

SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

SEDIMENT TRANSECT SAMPLING CHARACTERIZATION - PORTAGE CREEK TRANSECTS PCT9 TO PCT20

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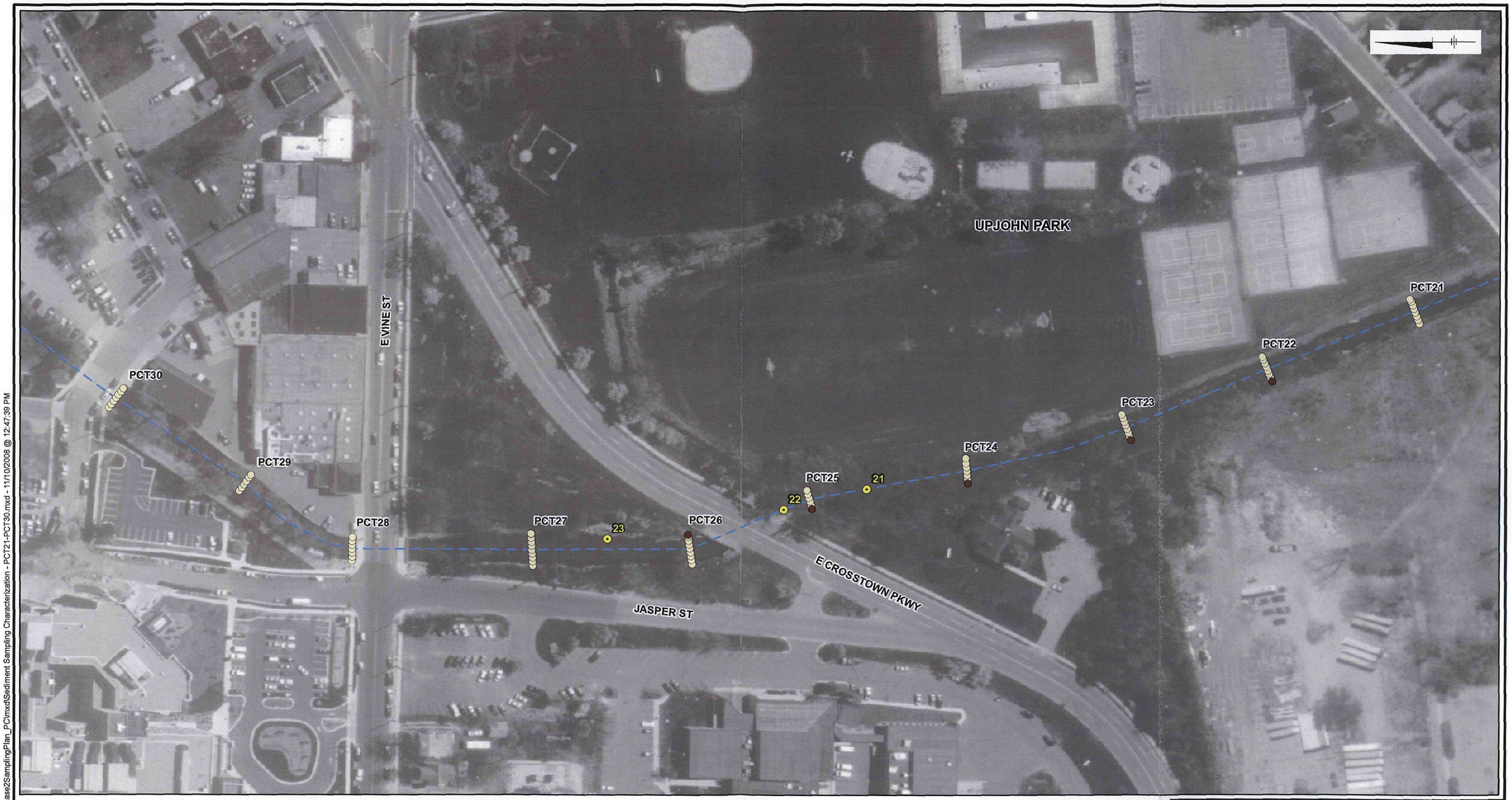
FIGURE 3

SYR-85 MTK KEW
KRSG (B0064524.0000,0500)
Q:\KRSG\MorrowDamToPlainwellDamSRI_Phase2SamplingPlan_PC\mxd\Sediment Sampling Characterization - PCT9-PCT20.mxd - 11/10/2008 @ 12:45:59 PM



LEGEND:

- SEDIMENT DEPOSIT LOCATION (APPROXIMATE)

SEDIMENT PROBING LOCATION

MATERIAL CLASSIFICATION:

- FINE
- COARSE
- PORTAGE CREEK CENTERLINE

0 120 240 Feet

GRAPHIC SCALE

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AIR LAND SURVEYS, INC., KALAMAZOO RIVER FLOWN 4/24/99, PORTAGE CREEK FLOWN 4/27/00.
2. SEDIMENT DEPOSIT LOCATIONS DESCRIBED IN TABLE 1.

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

SEDIMENT TRANSECT SAMPLING CHARACTERIZATION - PORTAGE CREEK TRANSECTS PCT21 TO PCT30

ARCADIS

FIGURE 4

SYR-85 MTK KEW
KRSG (B0064524.0000.0500)
Q:\KRSG\MorrowDamToPlainwellDamSRI_Phase2SamplingPlan_PC\mxd\Sediment Sampling Characterization - PCT21-PCT30.mxd - 11/10/2008 @ 12:47:39 PM

LEGEND:

- SEDIMENT DEPOSIT LOCATION (APPROXIMATE)
- SEDIMENT PROBING LOCATION
- MATERIAL CLASSIFICATION:
  - FINE
  - COARSE
- PORTAGE CREEK CENTERLINE

0 120 240 Feet

GRAPHIC SCALE

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AIR LAND SURVEYS, INC., KALAMAZOO RIVER FLOWN 4/24/99, PORTAGE CREEK FLOWN 4/27/00.
2. SEDIMENT DEPOSIT LOCATIONS DESCRIBED IN TABLE 1.

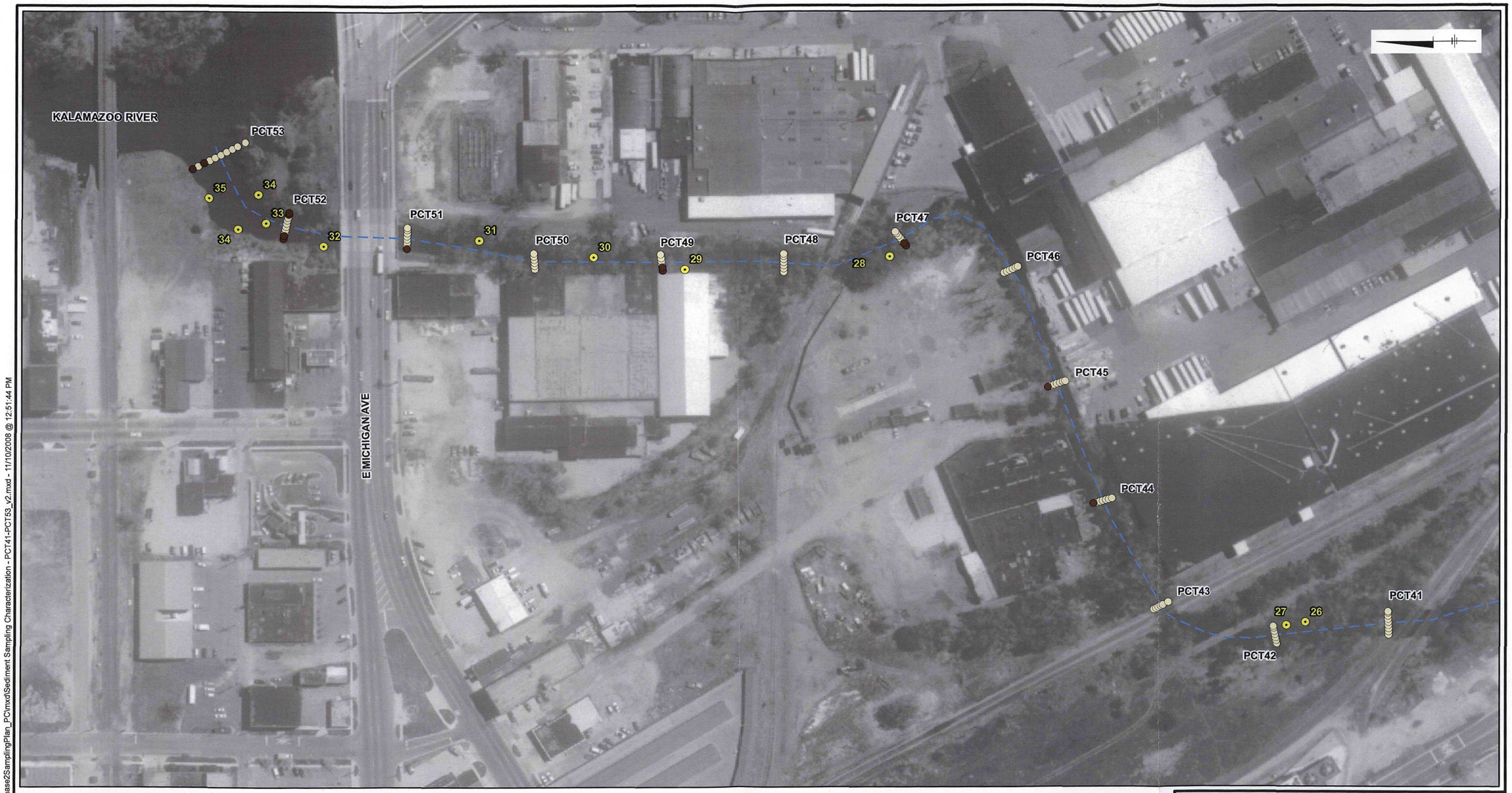
KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

SEDIMENT TRANSECT SAMPLING CHARACTERIZATION - PORTAGE CREEK TRANSECTS PCT31 TO PCT40

ARCADIS

FIGURE 5

SYR-85 MTK KEW
KRSG (B0064524.0000.0500)
Q:\KRSG\MorrowDamToPlainwellDam\SRI_Phase2SamplingPlan_PC\mxd\Sediment Sampling Characterization - PCT31-PCT40.mxd - 11/10/2008 @ 12:49:28 PM



LEGEND:

- SEDIMENT DEPOSIT LOCATION (APPROXIMATE)

SEDIMENT PROBING LOCATION

MATERIAL CLASSIFICATION:

- FINE
- COARSE

PORTAGE CREEK CENTERLINE

0 150 300 Feet

GRAPHIC SCALE

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AIR LAND SURVEYS, INC., KALAMAZOO RIVER FLOWN 4/24/99, PORTAGE CREEK FLOWN 4/27/00.
2. SEDIMENT DEPOSIT LOCATIONS DESCRIBED IN TABLE 1.

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

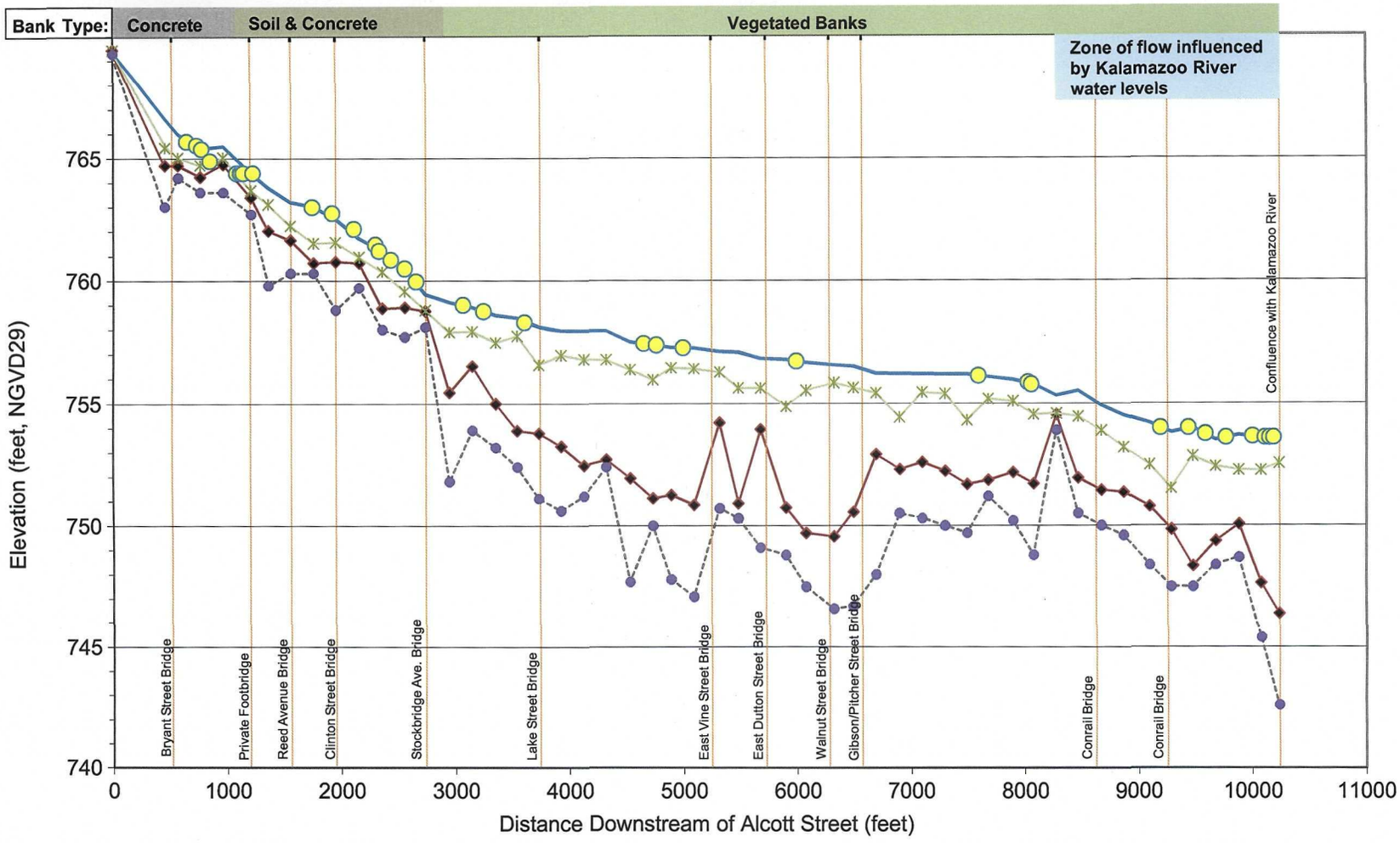
SEDIMENT TRANSECT SAMPLING CHARACTERIZATION - PORTAGE CREEK TRANSECTS PCT41 TO PCT53

ARCADIS

FIGURE 6

SYR-85 MTK KEW
KRSG (B0064524.0000.0500)
Q:\KRSG\Morrow\Dam1\PlainwellDam\SRI_Phase2SamplingPlan_PC\mxd\Sediment Sampling Characterization - PCT41-PCT53_v2.mxd - 11/10/2008 @ 12:51:44 PM

08/21/08 SYR-141ENV-DJH-KLS
B0064552/0000/00500/CDR/64552g16.CDR



NOTES:

1. PROFILE CREATED USING WATER SURFACE, BOTTOM OF SEDIMENT, AND TOP OF SEDIMENT ELEVATION DATA PRESENTED IN APPENDIX D OF THE AREA 1 PHASE 1 DATA REPORT (ARCADIS) SUBMITTED TO USEPA ON APRIL 11, 2008.
2. SEDIMENT DEPOSIT LOCATIONS APPROXIMATE, AND ARE SHOWN ON FIGURES 3-17 TO 3-21, AND APPROXIMATE DIMENSIONS AND VOLUMES PRESENTED IN TABLE 3-24 OF THE AREA 1 PHASE 1 DATA REPORT.
3. BRIDGE LOCATIONS ARE APPROXIMATE.

LEGEND:

- Water Surface
- Average Top of Sediment
- Sediment Deposit
- Average Bottom of Sediment
- Minimum Elevation for Limit of Probing at Transect

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK LONGITUDINAL PROFILE

ARCADIS

FIGURE 7

SYR-85 MTK KEW MTK
KRSG (64552.0500)
Q:\KRSG\MorrowDamToPlainwellDam\SRI_Phase2SamplingPlan_PC\mxd\Proposed Sediment Sample Locations - PC South_v3.mxd - 11/6/2008 @ 3:40:35 PM

LEGEND:

- 1993 LOCATION TO BE RESAMPLED
- PROPOSED CORE FOR TCL/TAL AND SEM/AVS ANALYSIS

PROPOSED SEDIMENT SAMPLE LOCATION
MATERIAL CLASSIFICATION:

- PROPOSED FINE SEDIMENT CORE LOCATION
- PROPOSED COARSE SEDIMENT CORE LOCATION
- PORTAGE CREEK CENTERLINE (APPROXIMATE)

NOTES:

1. PORTAGE CREEK CENTERLINE APPROXIMATED FROM SURVEYED SEDIMENT PROBE TRANSECT ENDPOINTS AND AERIAL PHOTOGRAPHY.
2. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AIR LAND SURVEYS, INC., KALAMAZOO RIVER FLOWN 4/24/99, PORTAGE CREEK FLOWN 4/27/00.

0 350 700 Feet
GRAPHIC SCALE

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PROPOSED SEDIMENT SAMPLE LOCATIONS - ALCOTT STREET TO CROSSTOWN PARKWAY

ARCADIS

FIGURE
8

SYR-85 MTK KEW MTK
KRSG (64552.0500)
Q:\KRSG\MorrowDamToPlainwellDam\SRI_Phase2SamplingPlan_PC\mxd\Proposed Sediment Sample Locations - PC North_v3.mxd - 11/6/2008 @ 3:43:26 PM

LEGEND:

- 1993 LOCATION TO BE RESAMPLED
- PROPOSED CORE FOR TCL/TAL AND SEM/AVS ANALYSIS

PROPOSED SEDIMENT SAMPLE LOCATION
MATERIAL CLASSIFICATION:

- PROPOSED FINE SEDIMENT CORE LOCATION
- PROPOSED COARSE SEDIMENT CORE LOCATION
- PORTAGE CREEK CENTERLINE (APPROXIMATE)

NOTES:

1. PORTAGE CREEK CENTERLINE APPROXIMATED FROM SURVEYED SEDIMENT PROBE TRANSECT ENDPOINTS AND AERIAL PHOTOGRAPHY.
2. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AIR LAND SURVEYS, INC., KALAMAZOO RIVER FLOWN 4/24/99, PORTAGE CREEK FLOWN 4/27/00.

0 350 700 Feet
GRAPHIC SCALE

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PROPOSED SEDIMENT SAMPLE LOCATIONS - CROSSTOWN PARKWAY TO KALAMAZOO RIVER

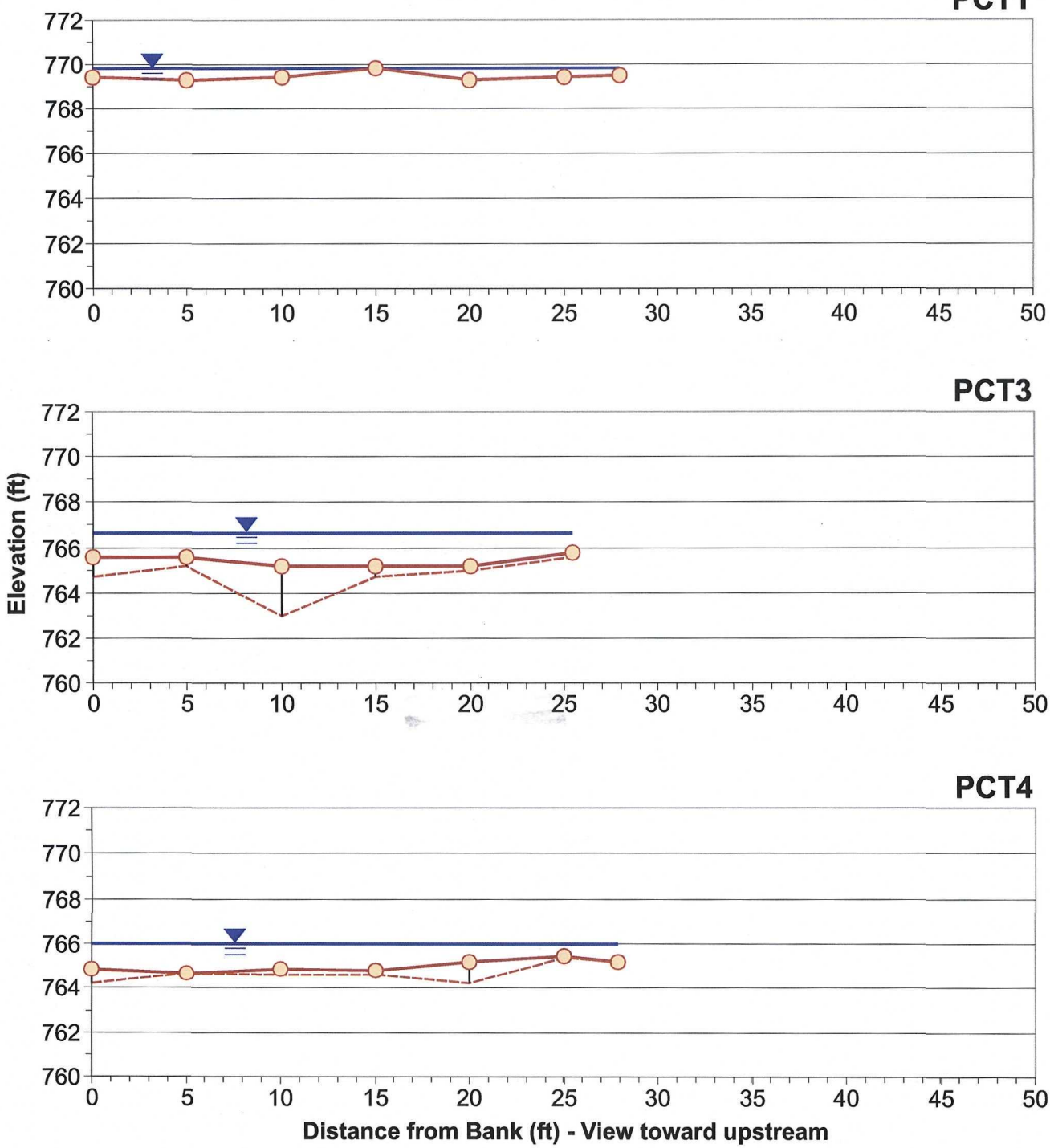
ARCADIS

FIGURE
9

ARCADIS

Attachment 1

Portage Creek Transect Cross Sections



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location

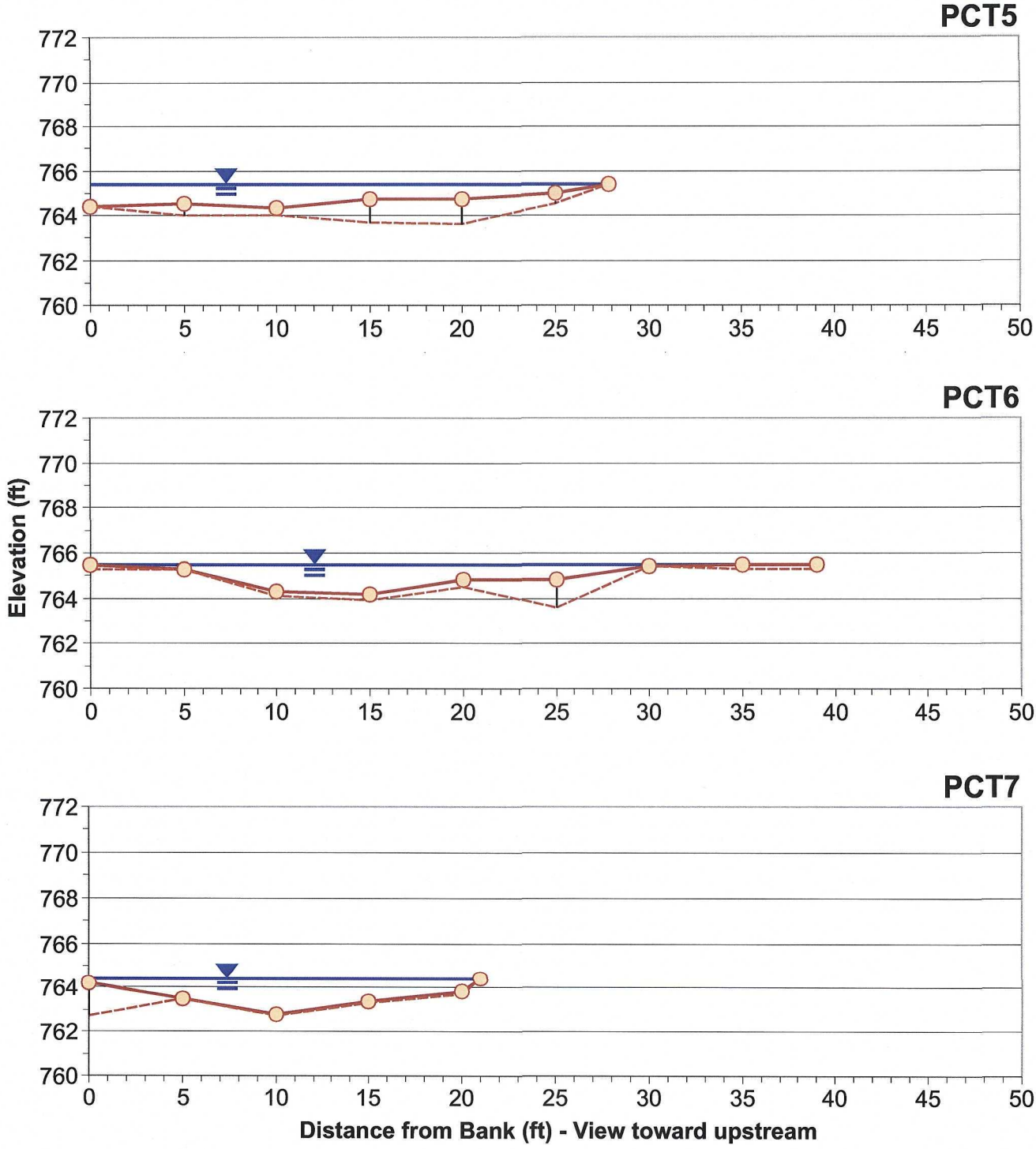
KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT1, PCT3, AND PCT4

ARCADIS

ATTACHMENT 1

11/06/08 SYR-D85-DJH
B0064552/0000/000500/CDR/64552G01.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location

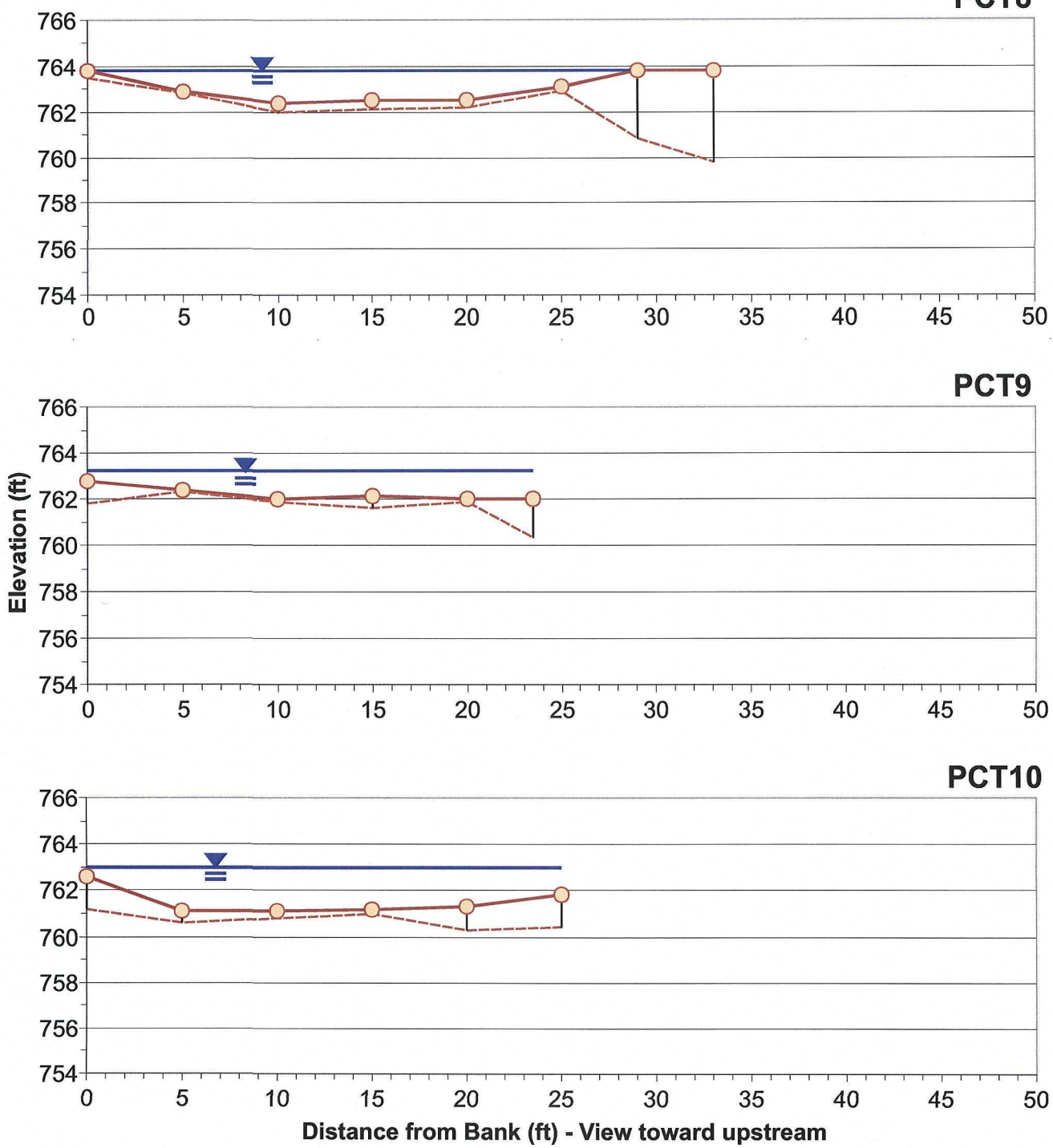
KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT5 - PCT7

ARCADIS

ATTACHMENT 1

11/06/08 SYR-141ENV-DJH
B0064552/0000/00500/CDR/64552G02.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location

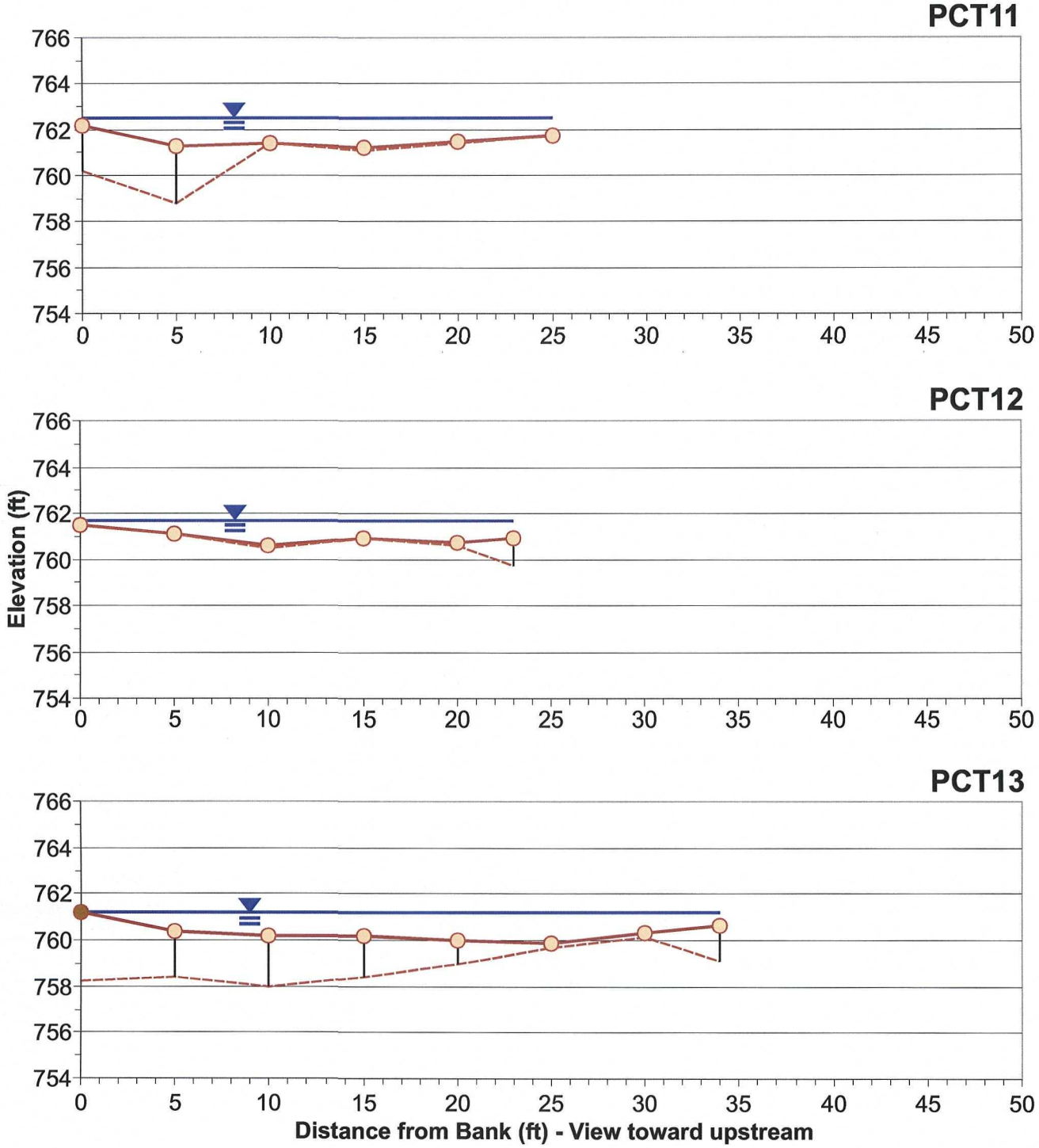
KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT8 - PCT10

ARCADIS

ATTACHMENT 1

11/06/08 SYR-141ENV-DJH
B0064552/0000/00500/CDR/64552G03.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location
- Fine Sediment Location

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

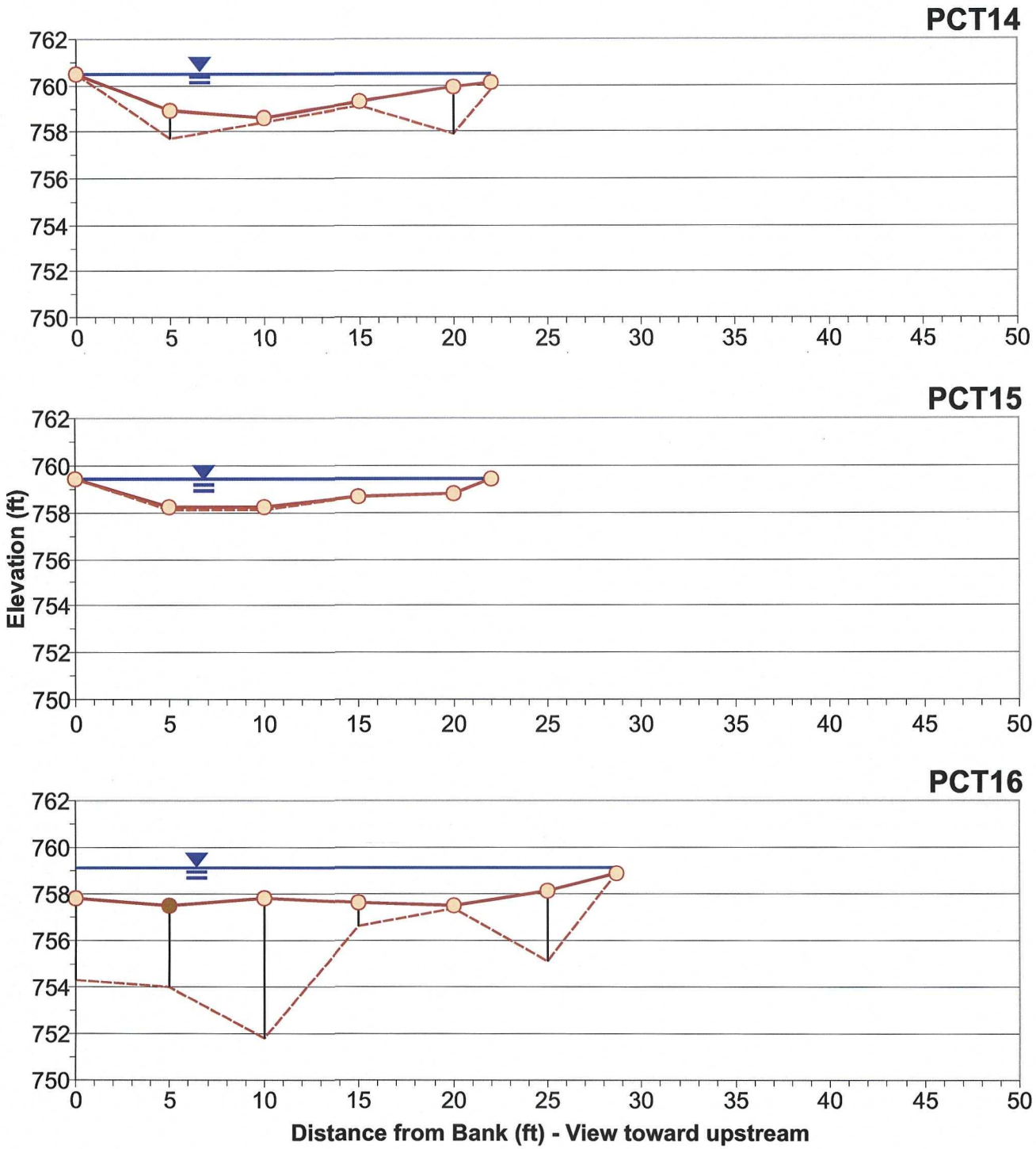
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT11 - PCT13

ARCADIS

ATTACHMENT 1

11/05/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G04.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location
- Fine Sediment Location

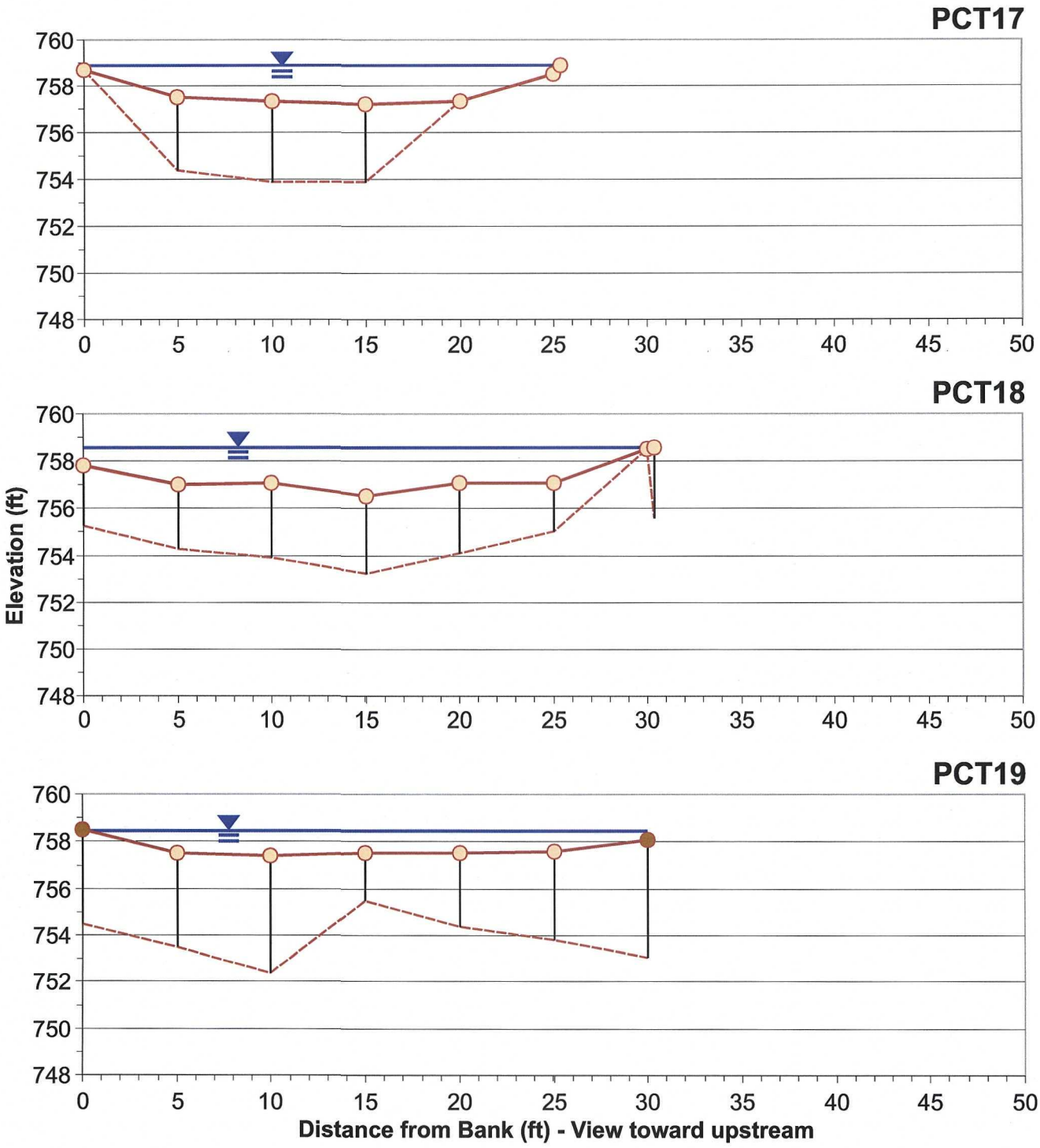
KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT14 - PCT16

ARCADIS

ATTACHMENT 1

11/08/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G05.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location
- Fine Sediment Location

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

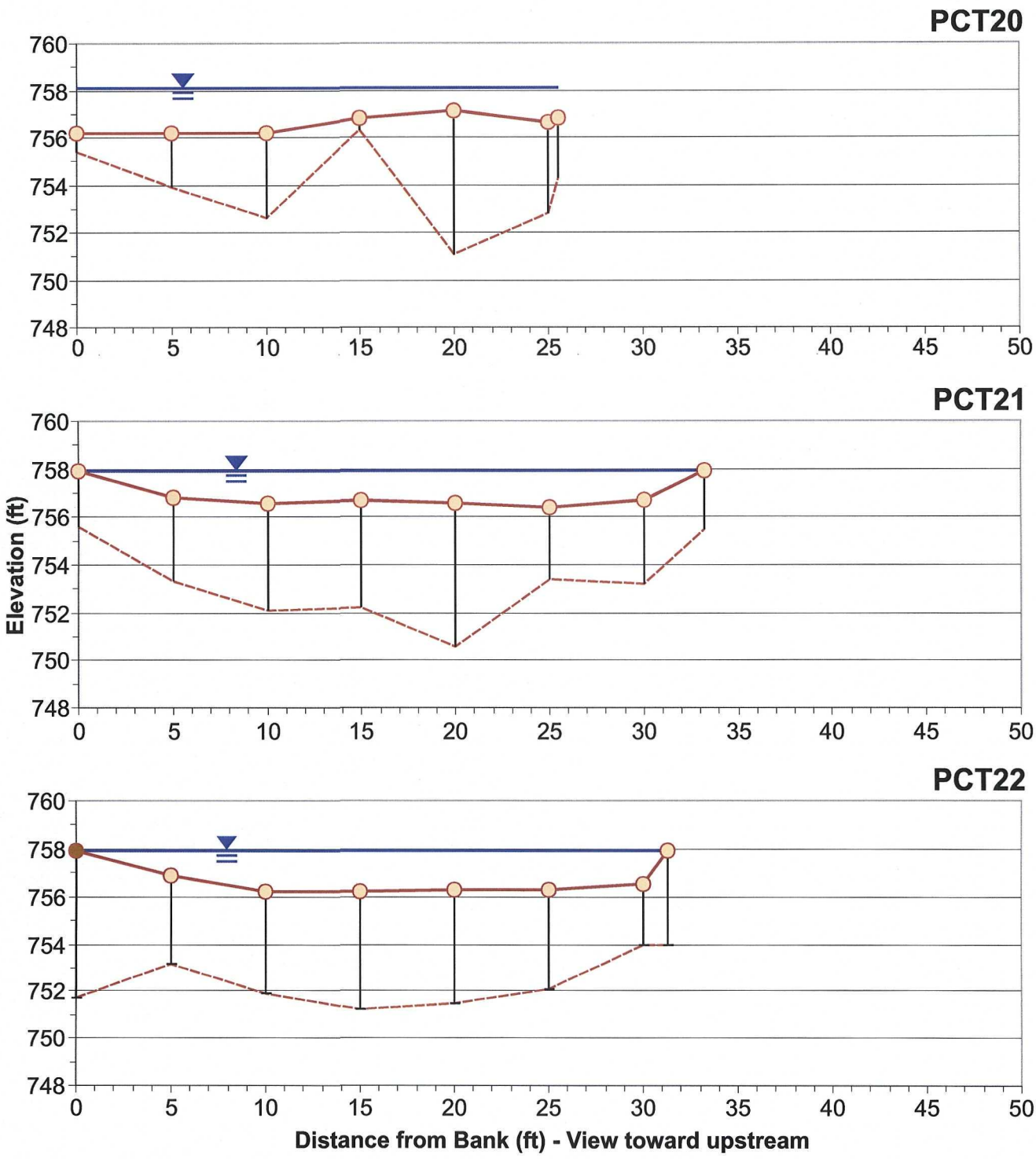
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT17 - PCT19

ARCADIS

ATTACHMENT 1

11/06/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G06.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location
- Fine Sediment Location

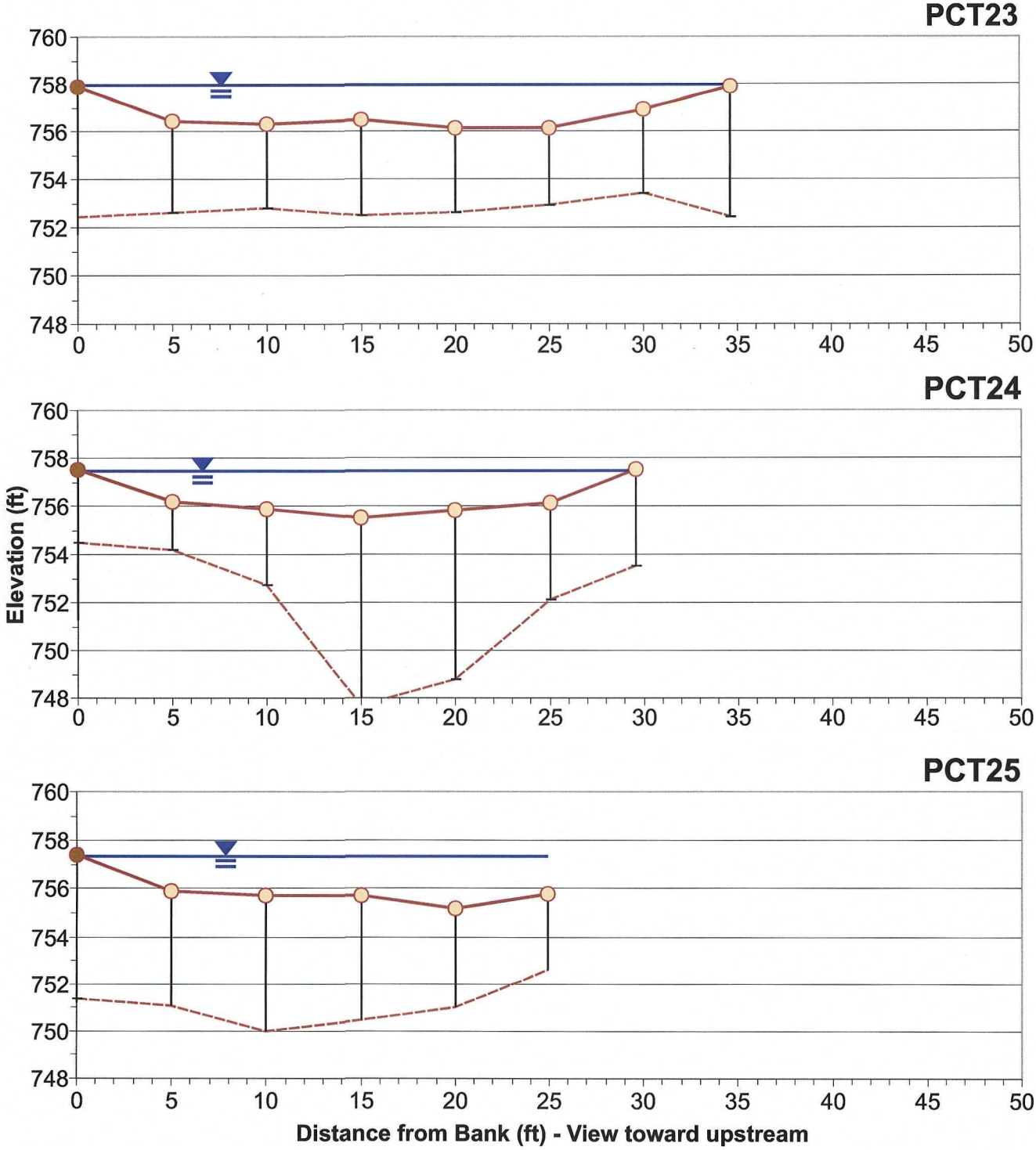
KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT20 - PCT22

ARCADIS

ATTACHMENT 1

11/06/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G07.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location
- Fine Sediment Location

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

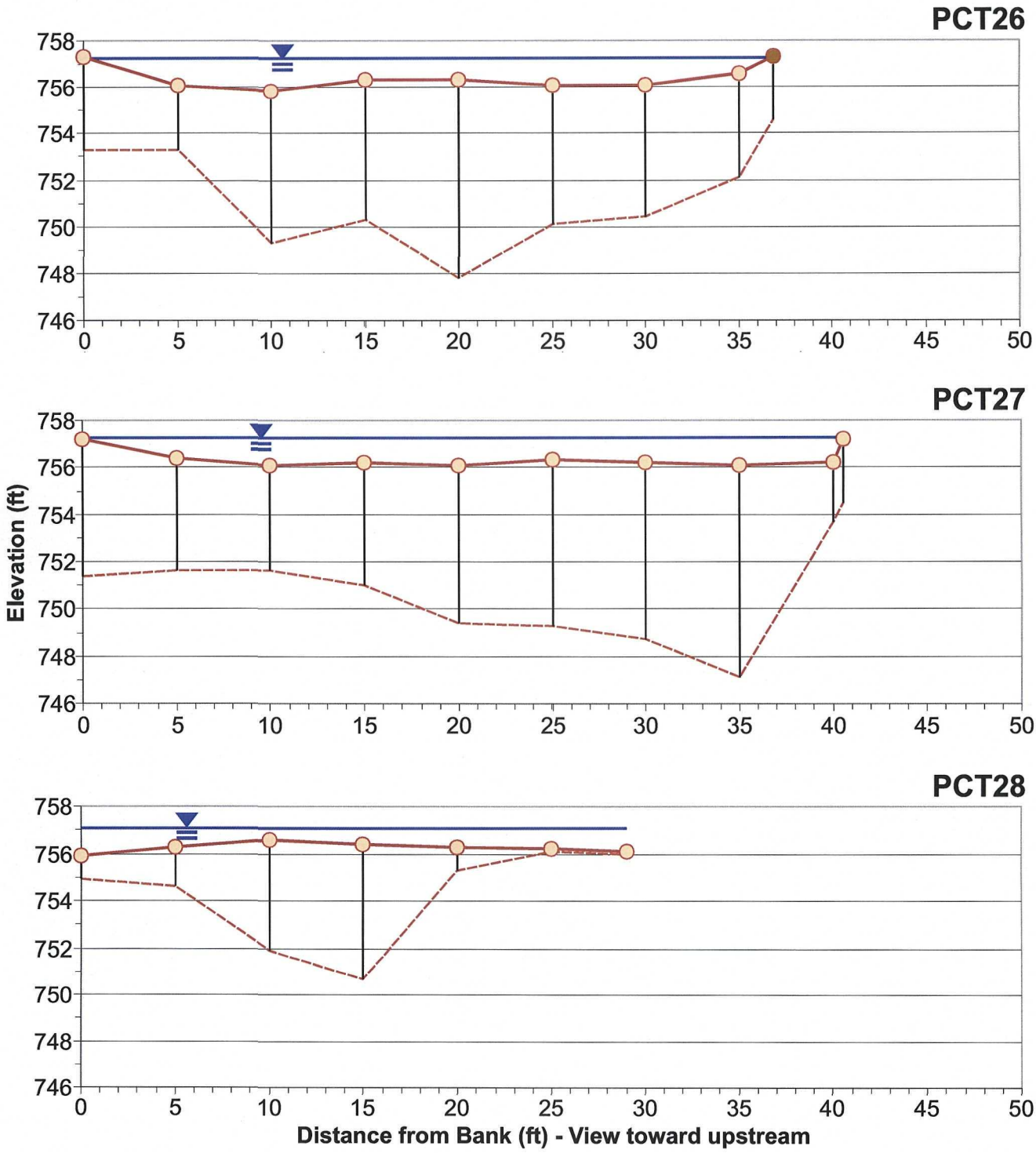
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT23 - PCT25

ARCADIS

ATTACHMENT 1

08/06/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G08.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location
- Fine Sediment Location

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

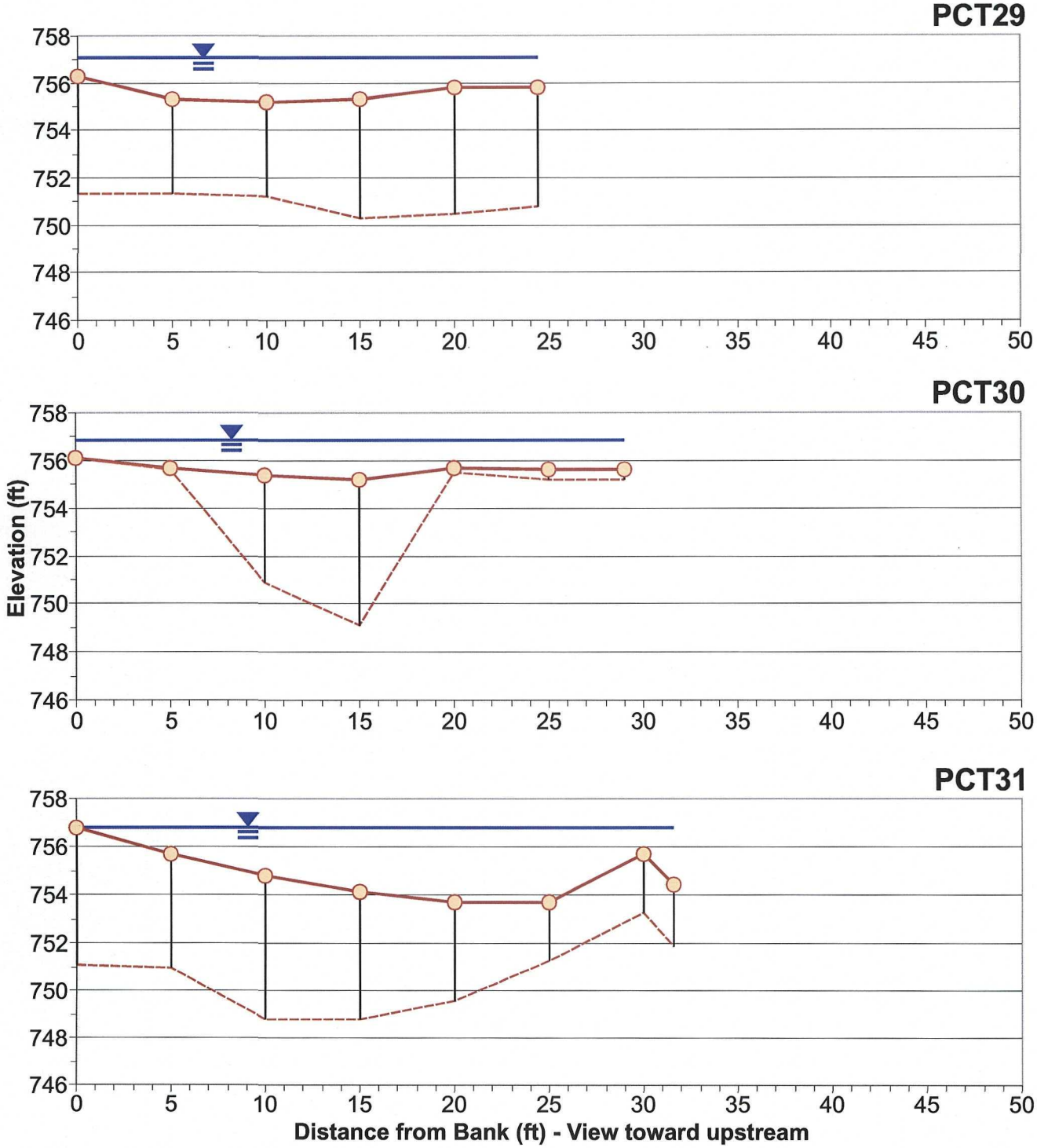
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT26 - PCT28

ARCADIS

ATTACHMENT 1

08/06/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G09.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location
- Fine Sediment Location

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

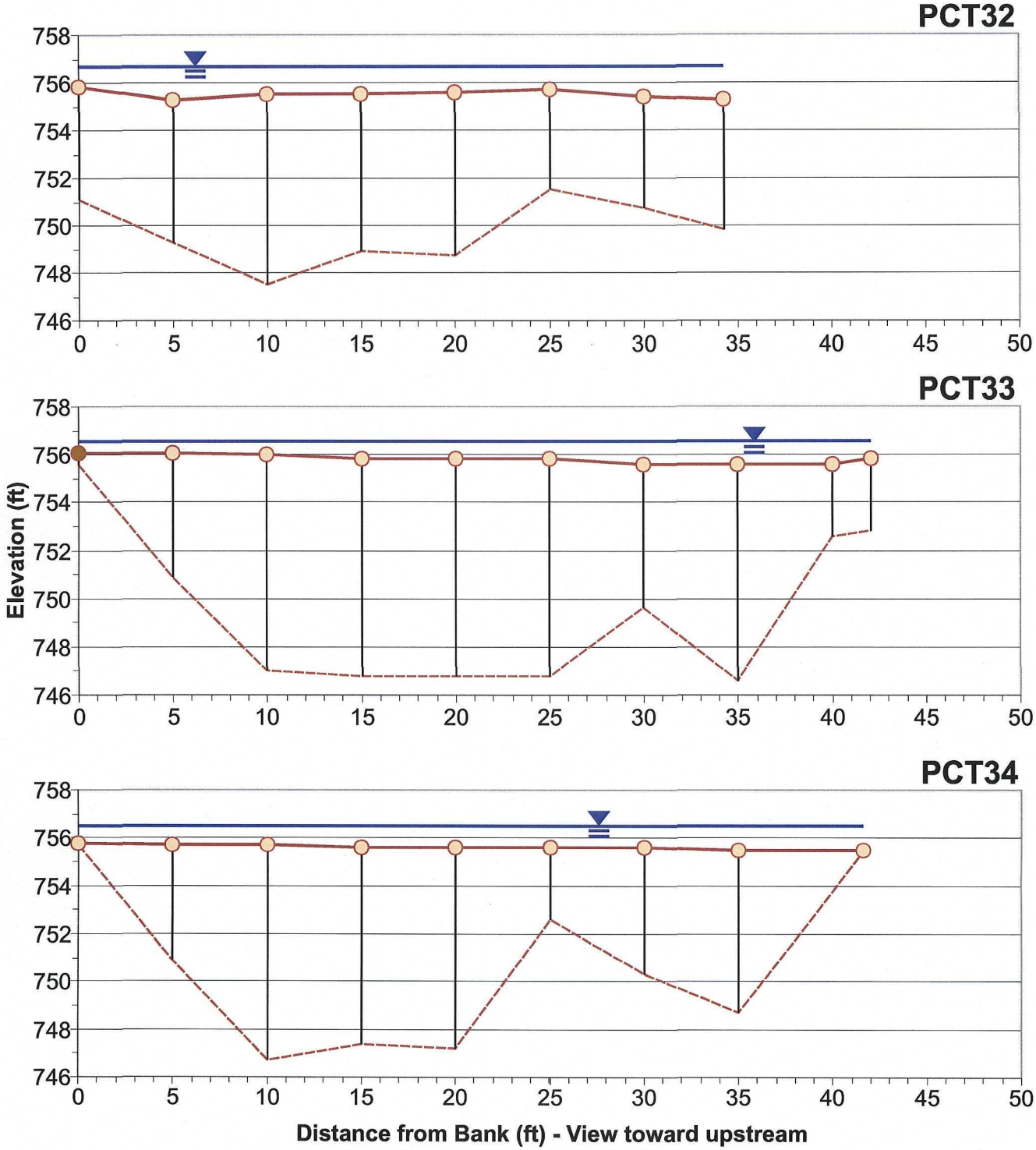
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT29 - PCT31

ARCADIS

ATTACHMENT 1

08/06/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G10.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location
- Fine Sediment Location

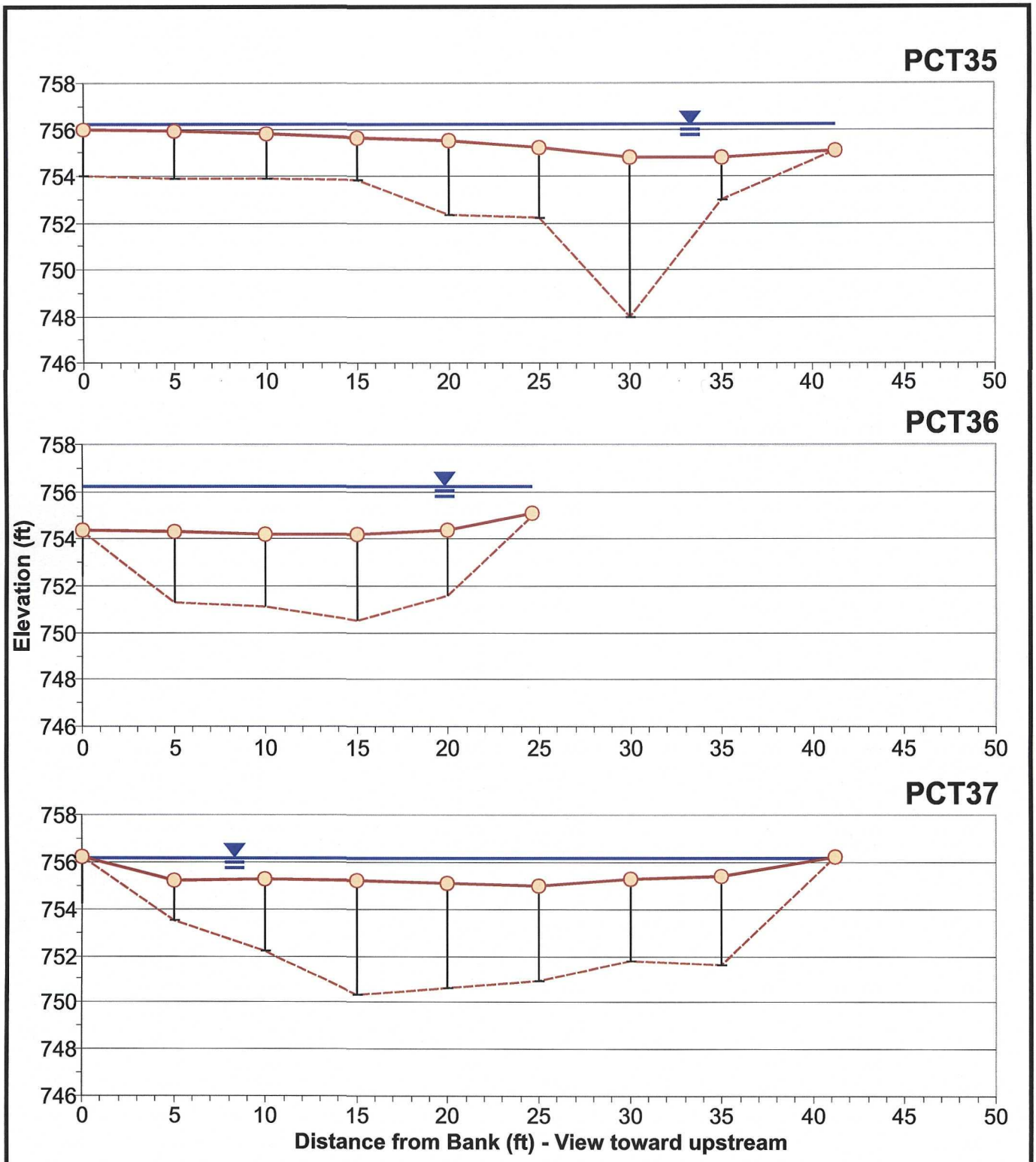
KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR
PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS
PCT32 - PCT34

ARCADIS

ATTACHMENT
1

08/06/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G11.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location
- Fine Sediment Location

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

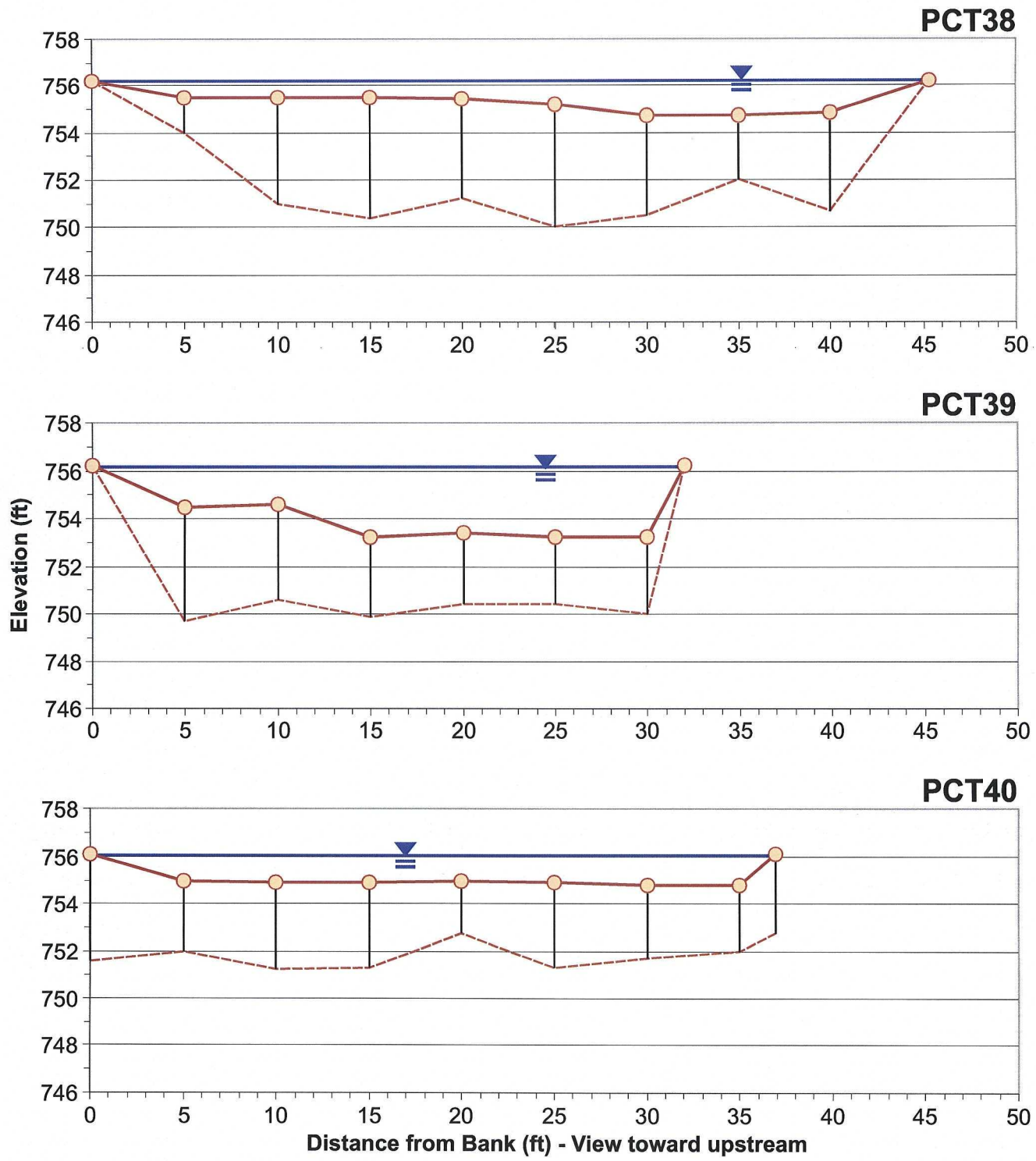
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PTC35 - PTC37

ARCADIS

ATTACHMENT 1

08/06/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G12.CDR



KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

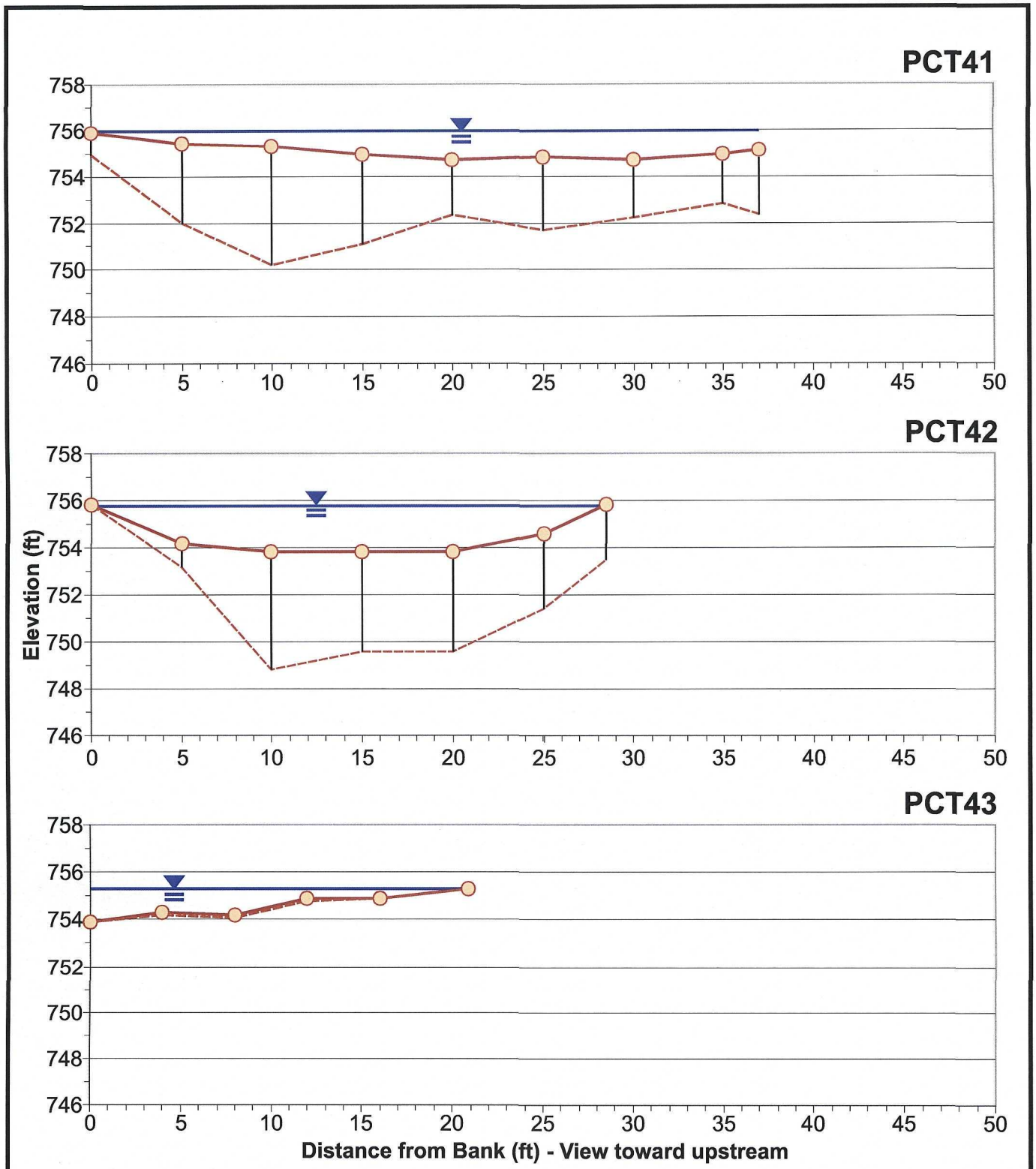
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT38 - PCT40

ARCADIS

ATTACHMENT 1

11/06/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G13.CDR



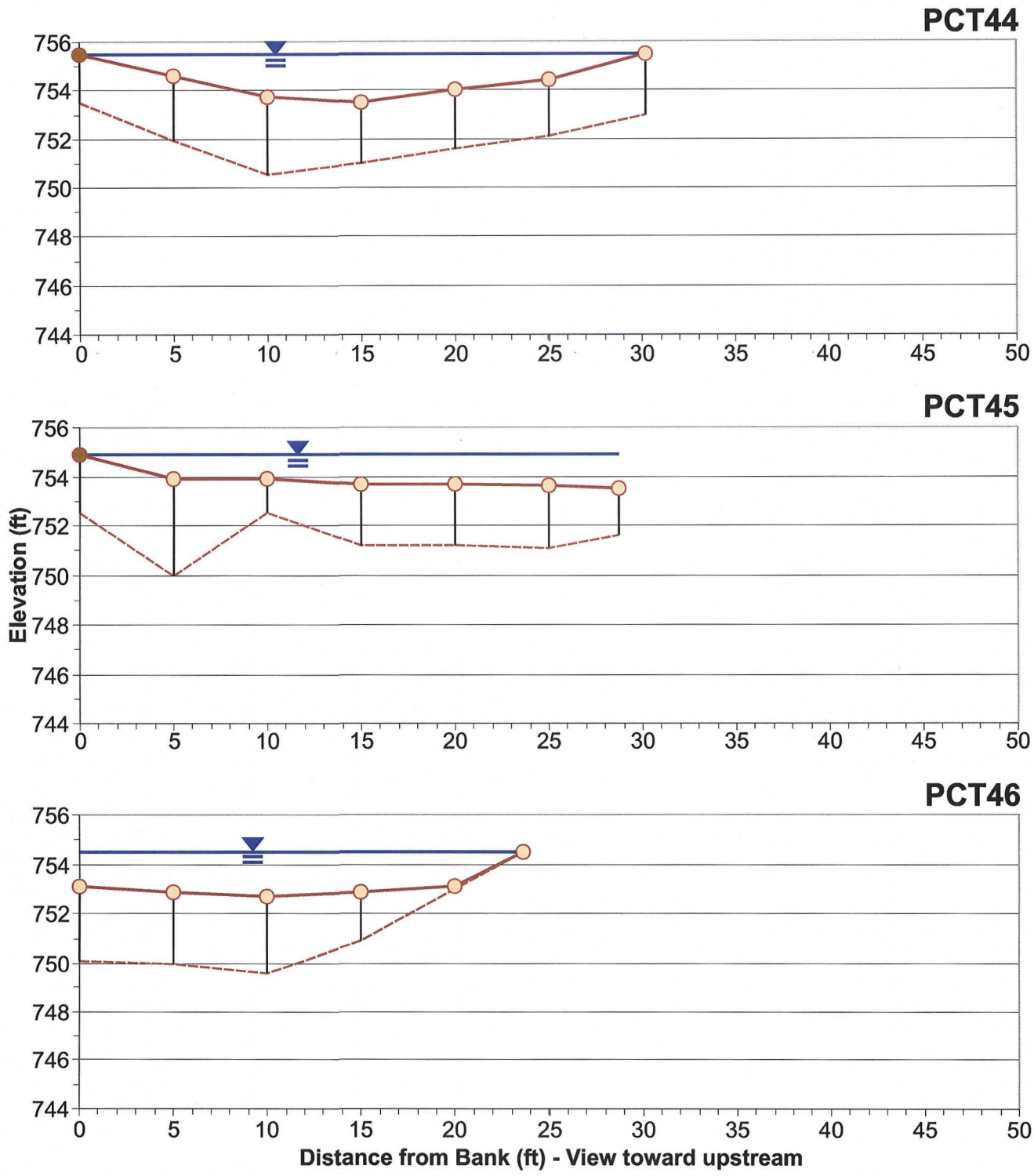
KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT41 - PCT43

ARCADIS

ATTACHMENT 1

11/06/08 SYR-D85-DJH
B0064552/0000/000500/CDR/64552G14.CDR



KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

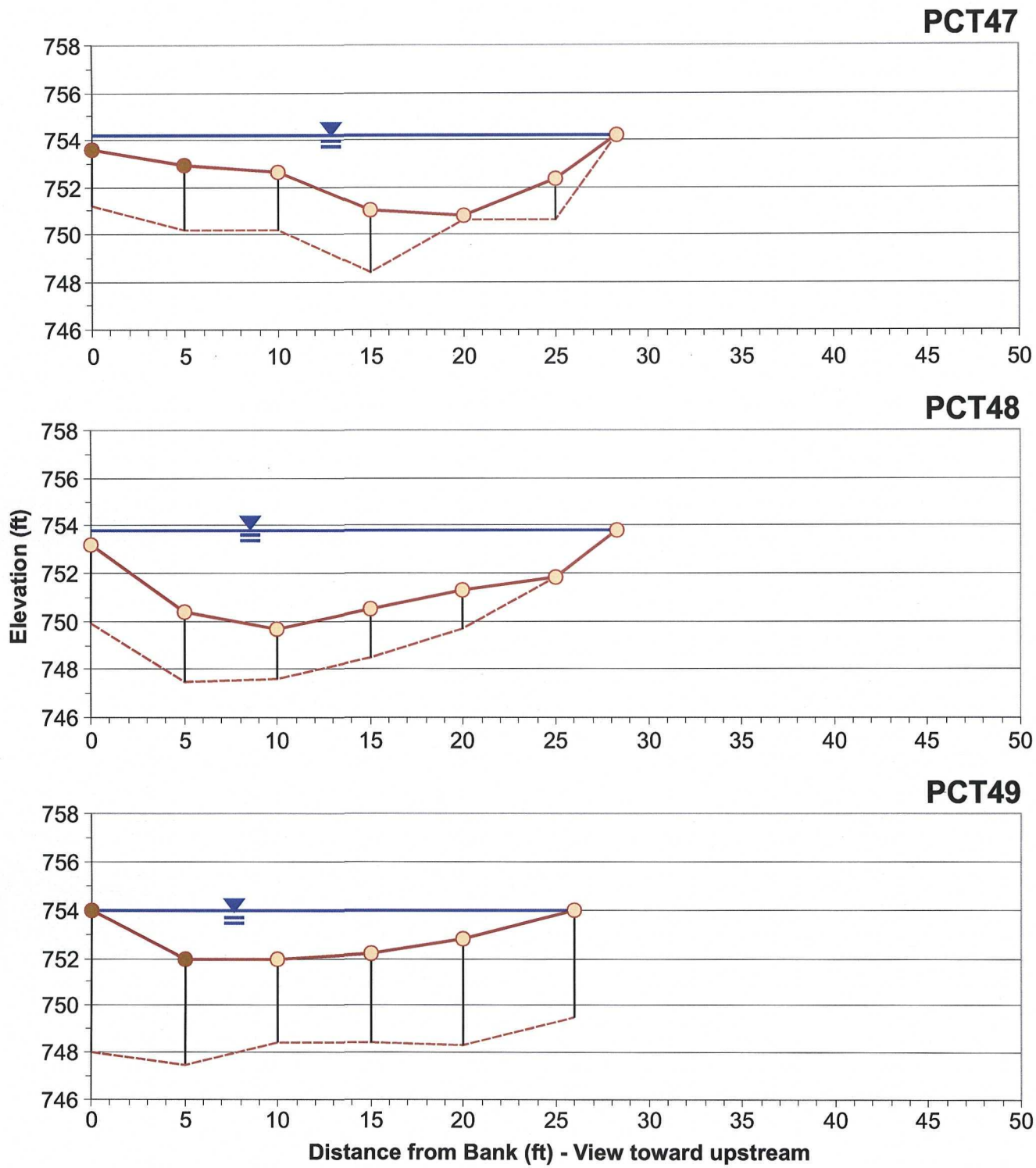
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT44 - PCT46

ARCADIS

ATTACHMENT 1

11/08/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G15.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location
- Fine Sediment Location

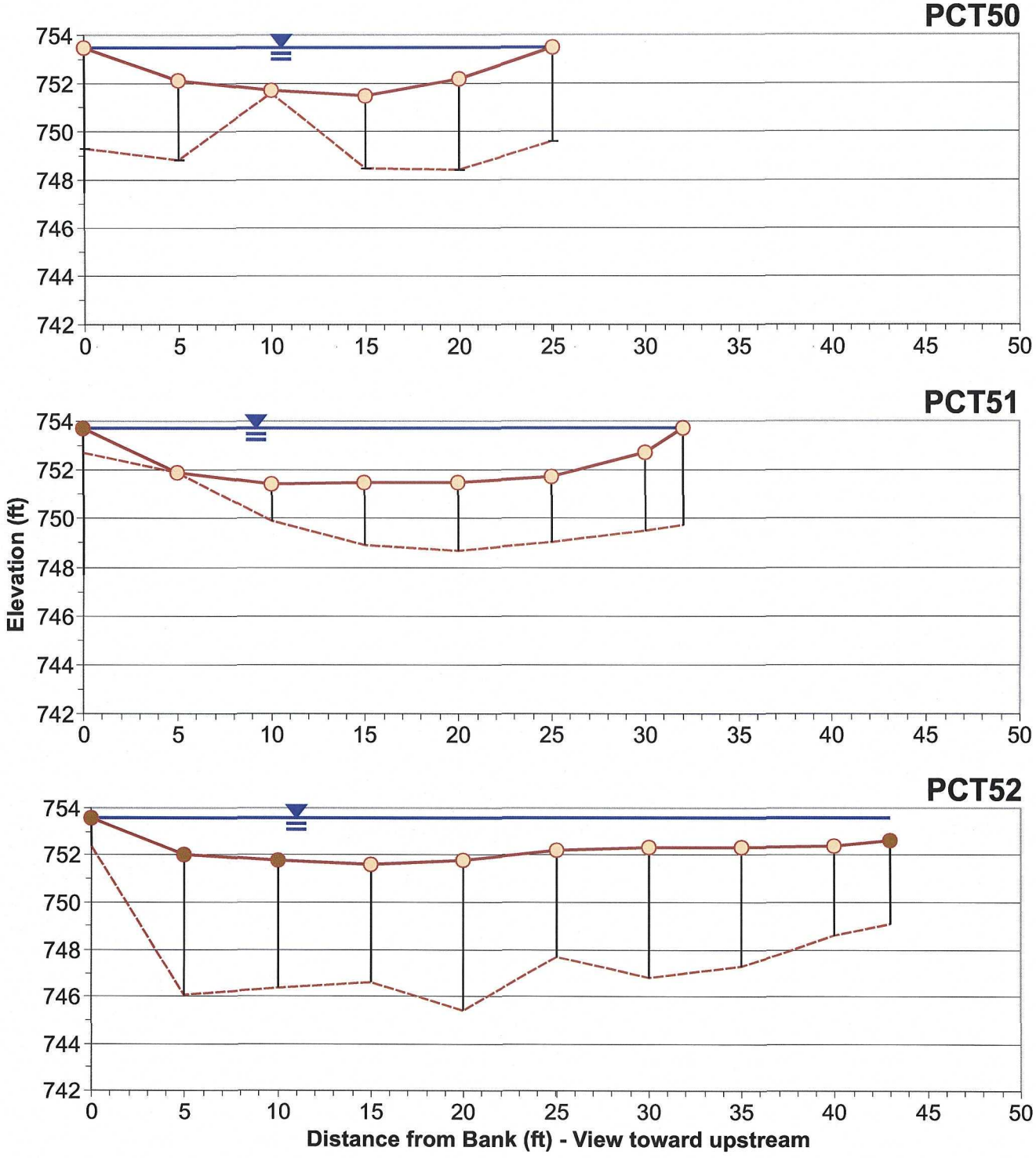
KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT47 - PCT49

ARCADIS

ATTACHMENT 1

11/06/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G16.CDR



LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location
- Fine Sediment Location

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

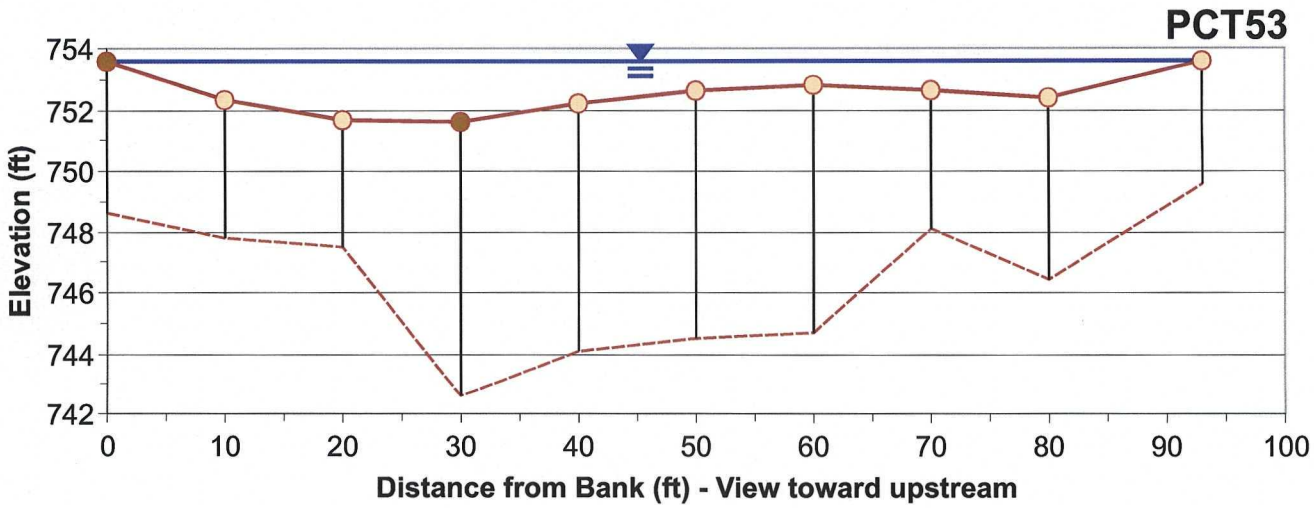
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS PCT50 - PCT52

ARCADIS

ATTACHMENT 1

08/06/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G17.CDR



NOTE:
The horizontal scale used on this transect is twice as large (100 ft vs. 50 ft) as that used on all other Portage Creek transects.

LEGEND:

- Water Surface Elevation
- Bottom of Sediment
- Sediment Surface Elevation
- Coarse Sediment Location
- Fine Sediment Location

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
SRI PHASE 2 SAMPLING PLAN FOR PORTAGE CREEK SEDIMENT INVESTIGATION

PORTAGE CREEK TRANSECTS
PCT53

ARCADIS

ATTACHMENT
1

11/06/08 SYR-D85-DJH
B0064552/0000/00500/CDR/64552G18.CDR